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METAL FINISHING

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**Corrosion Resistant Materials — Metals
and Alloys**

Characteristics and Applications

Vapor Stripping of Stop-off Coatings

Methylene Chloride in Converted Degreaser

**Maintenance of Electrical Equipment in the
Plating Room**

Generators, Rectifiers, Rheostats, and Meters

Barrel Finishing

Deburring and Allied Processes

Finishing Pointers

Diffused Nickel — Cadmium Deposits

Science for Electroplaters

Cyanide Disposal Methods

Complete Contents Page 55

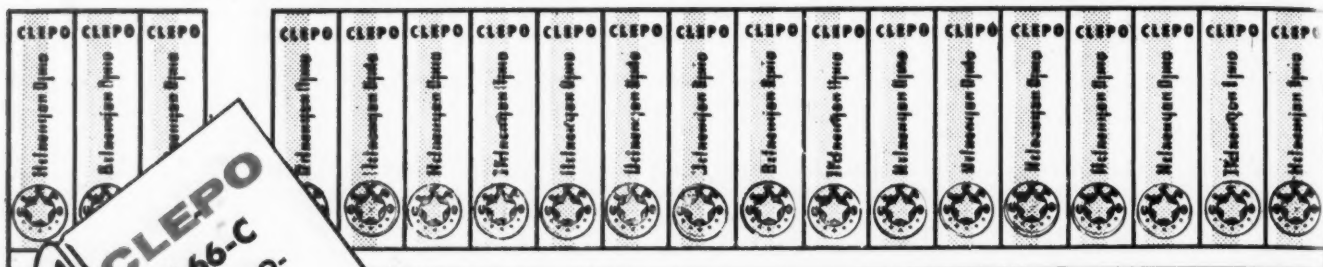


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FINISHING PUBLICATIONS, INC.

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CLEPO 166-C might be likened to a bird dog. It knows how to find the hidden quarry—dirt in out of the way places. With its unusual qualities, this cleaner gets into recesses, holes, corners, back of sections, tube interiors, to loosen the dirt whether oil, grease, emery or other soil material. It removes smut. It rinses freely and clears away loosened dirt from hidden spots. It can be used with either hard or soft water. Generally used as an anodic cleaner at 6 volts, CLEPO 166-C can also be used as a direct electrocleaner.

The next time a CLEPO Field Service man calls, ask him to demonstrate the effectiveness of CLEPO 166-C. Or write us for a trial sample.

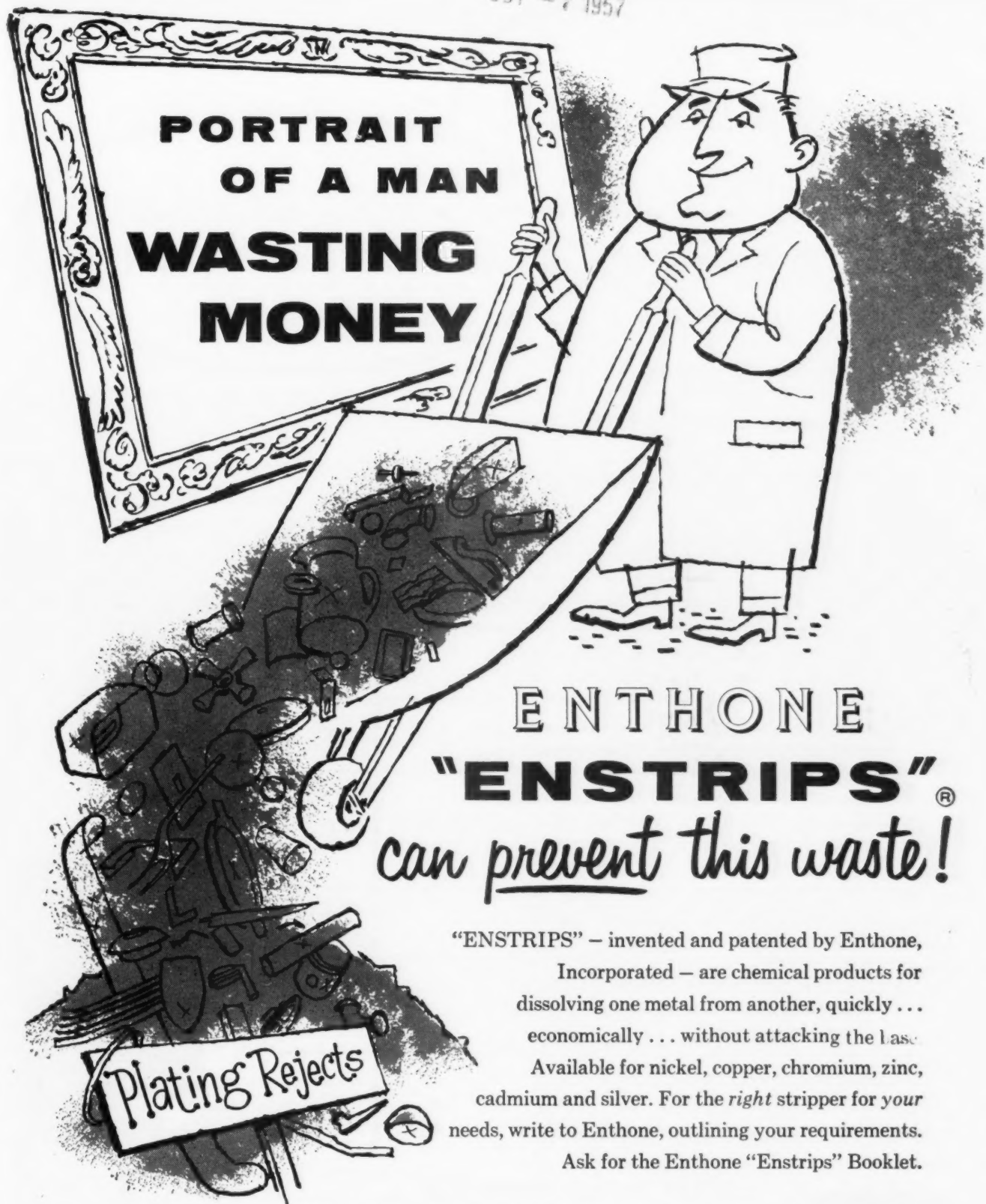
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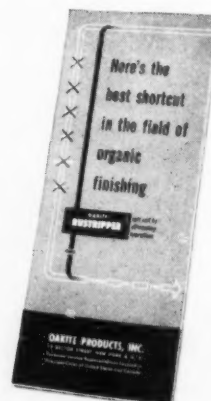
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How to remove epon lacquers, paints and enamels.	A
How to strip paint, pigment residues, phosphate coatings, rust and oil in one operation.	B
How to strip paint from rejects, conveyor chains, racks and hooks in continuous operation.	B
How to strip oil-base paints ... synthetic enamels ... alkali-resistant plastics ... resin-base paints ... japans ... wrinkle finishes ... nitrocellulose lacquers ... alkyds ... phenolics ... ureas	C
How to strip zinc chromate primers without etching aluminum.	C
How to strip paint from vertical surfaces and undersurfaces where thin-bodied strippers run off without stripping	C
How to strip metal parts that are too large to be soaked in tanks.	C



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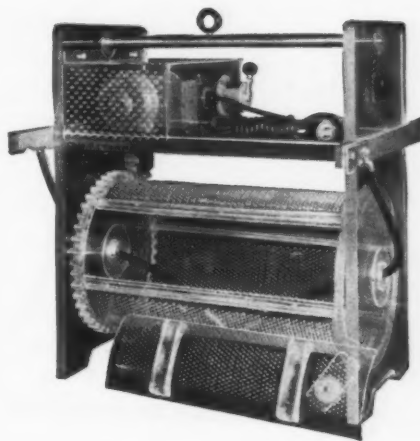
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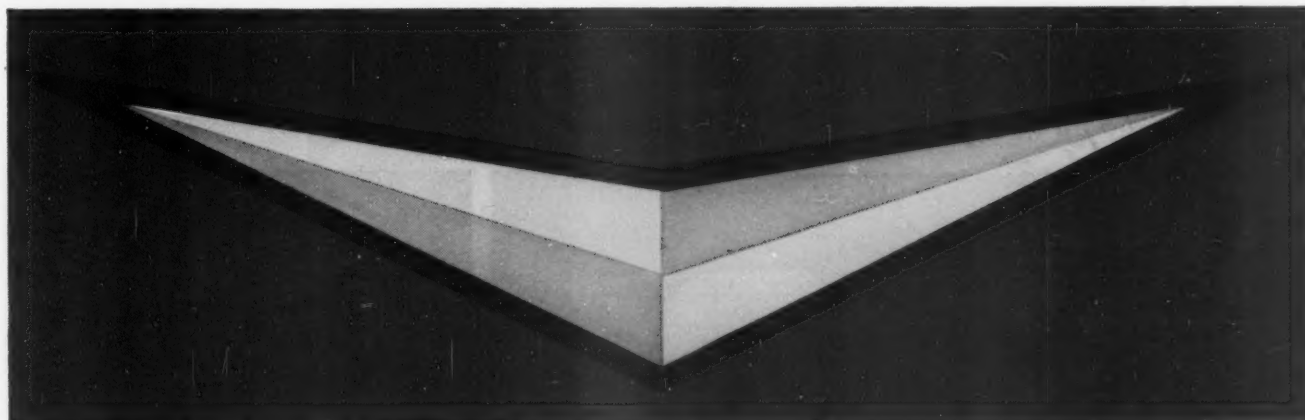
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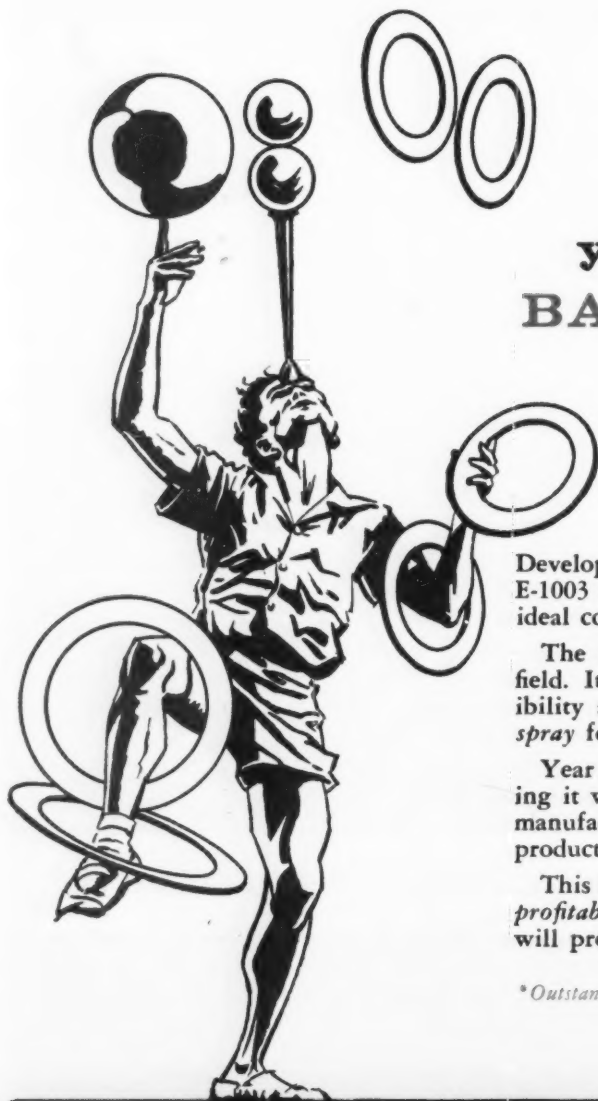
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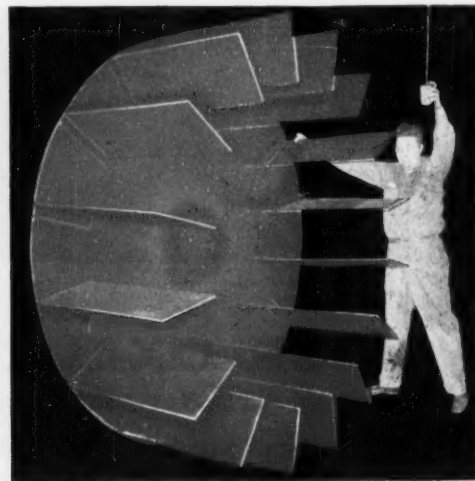
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 and coaters

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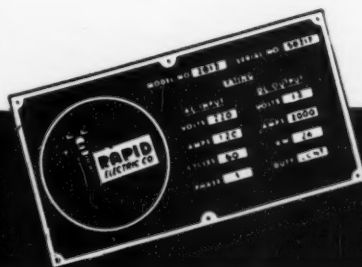
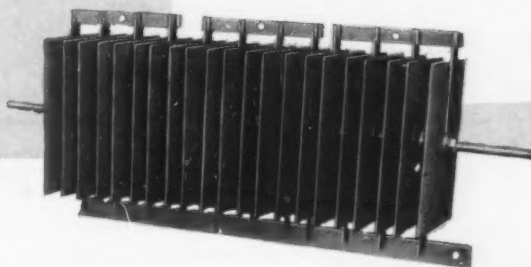
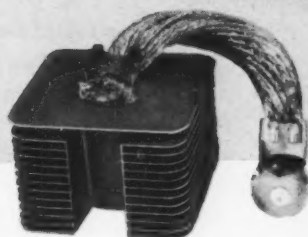
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A Timely Message on The Role of the Sales Engineer

by Ben P. Sax

Chairman of the Board, American Buff Company

In the popular mind, a sales engineer, as well as any other salesman, is often thought of as an aggressive, back-slapping, hand-shaking, 3-martini-lunch man with the heart of a playboy. Indeed, many people are just a little envious of this person who seemingly does no work for a high salary. Mainly a myth, this popular conception is an interesting study in the evolution of modern sales methods and techniques.

In the earlier years of the 20th century, sales engineers as we know them were virtually non-existent. Most salesmen in these "good old days" relied strongly, if not entirely, on the force of their personality. Being a "good Joe" did in fact result in getting orders. This is the salesman-image that lurks deep down in the minds of most of us. It's also the basis for the popular misconception that often obscures the vital and totally necessary role played by the sales engineer in today's robust economy.

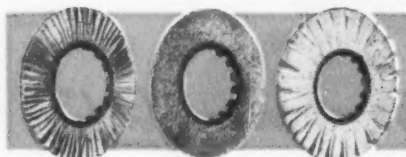
The impact of product proliferation and specialization on our expanding economy literally created the sales engineer. Wherever you look in industry today, he is serving as a vital link in relating specific products to specific customer needs. The warm handshake is still there of course, but today's engineer who sells is a veritable storehouse of information. He coordinates products to plans in order to help solve particular problems that customers have. As such, the sales engineer is a valued member of the executive team and well worth his compensation.

If *your* problems involve metal finishing, we cordially invite you to call upon a professional-type sales engineer from American Buff. He is eager and able to serve you.

Sincerely,

Ben P. Sax

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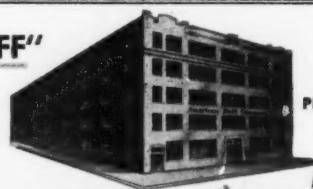
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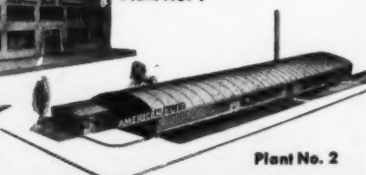
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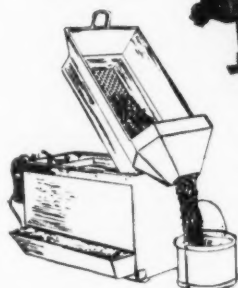
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for
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or
Sawdust



Just pour mixed work into hopper and press button. Motor shakes hopper and burnishing balls, chips, etc. fall through screen—leaves clean work in hopper.

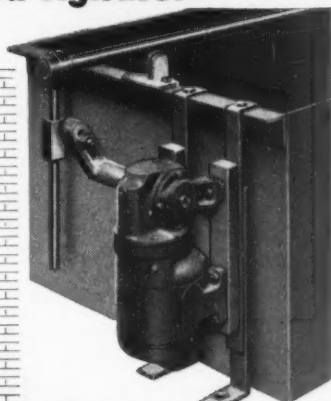
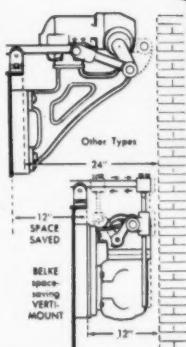
Hopper tilts to pour out work—Balls, chips, etc. fall into removable tray.

Shaker rides on ball bearing rollers. Hopper sides lined with wood to protect parts with high finish.

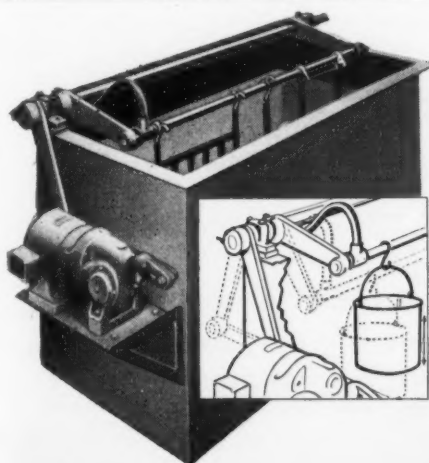
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and floor—
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for speci-
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The motor moves the bar up and down, with a positive churning motion. Forces solution in and out of intricate openings difficult to clean by hand.

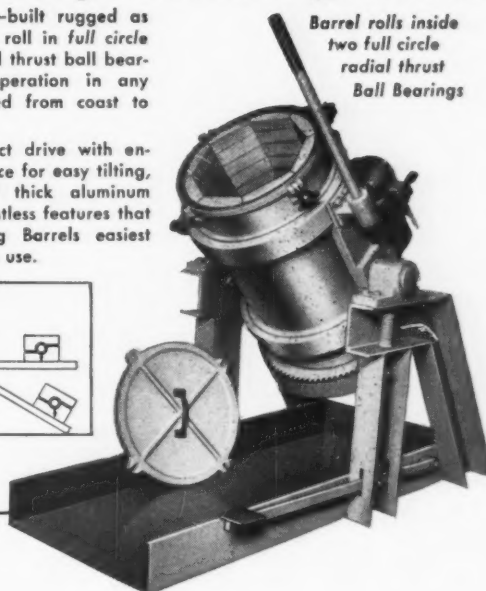
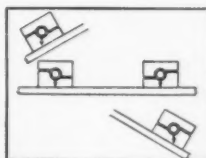
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bearings

assure smooth anti-
friction rolling in
any position.



Barrel rolls inside
two full circle
radial thrust
Ball Bearings

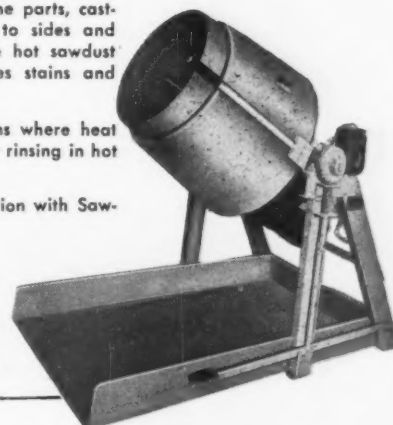
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Can be furnished in combination with Sawdust Separator.

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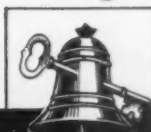


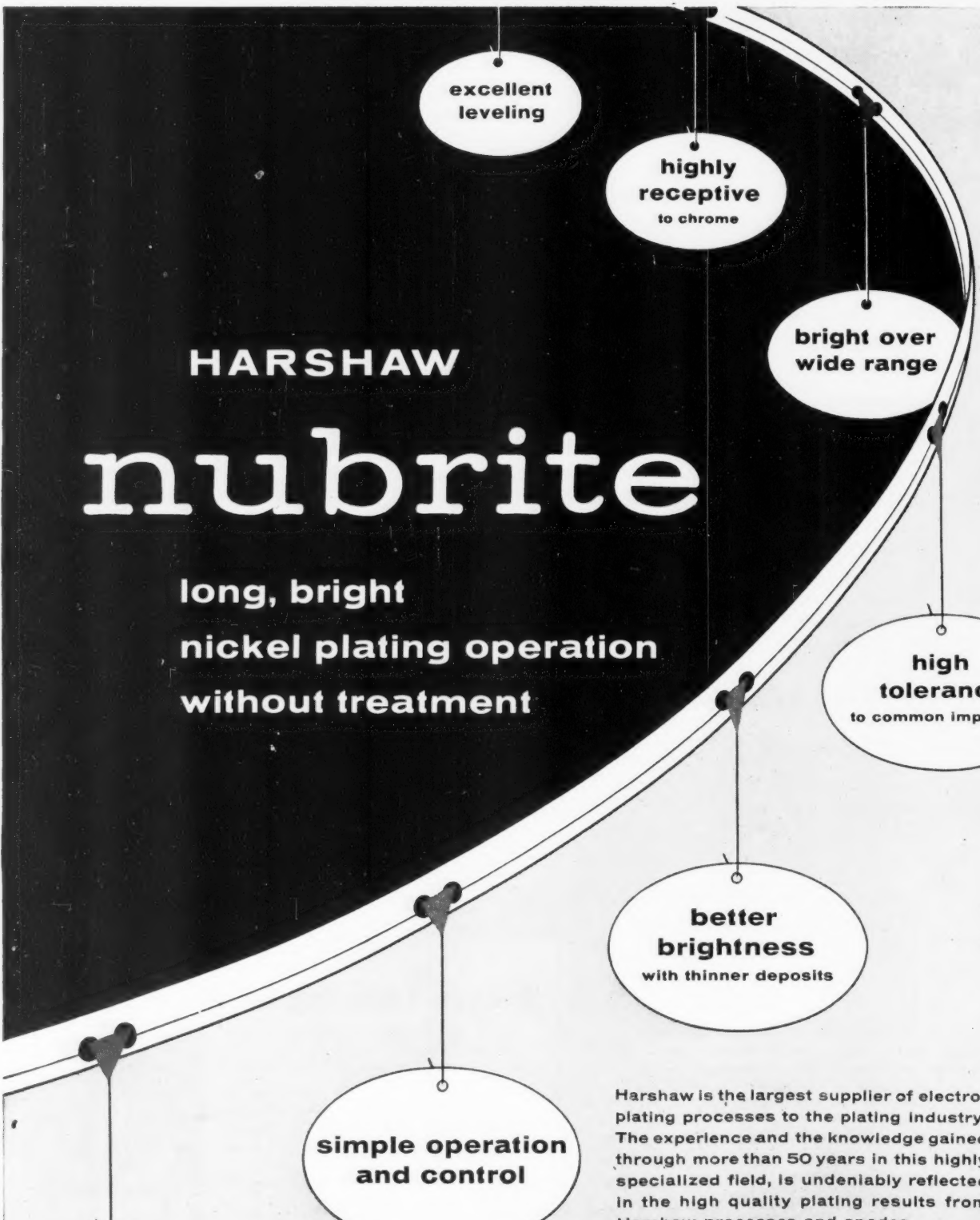
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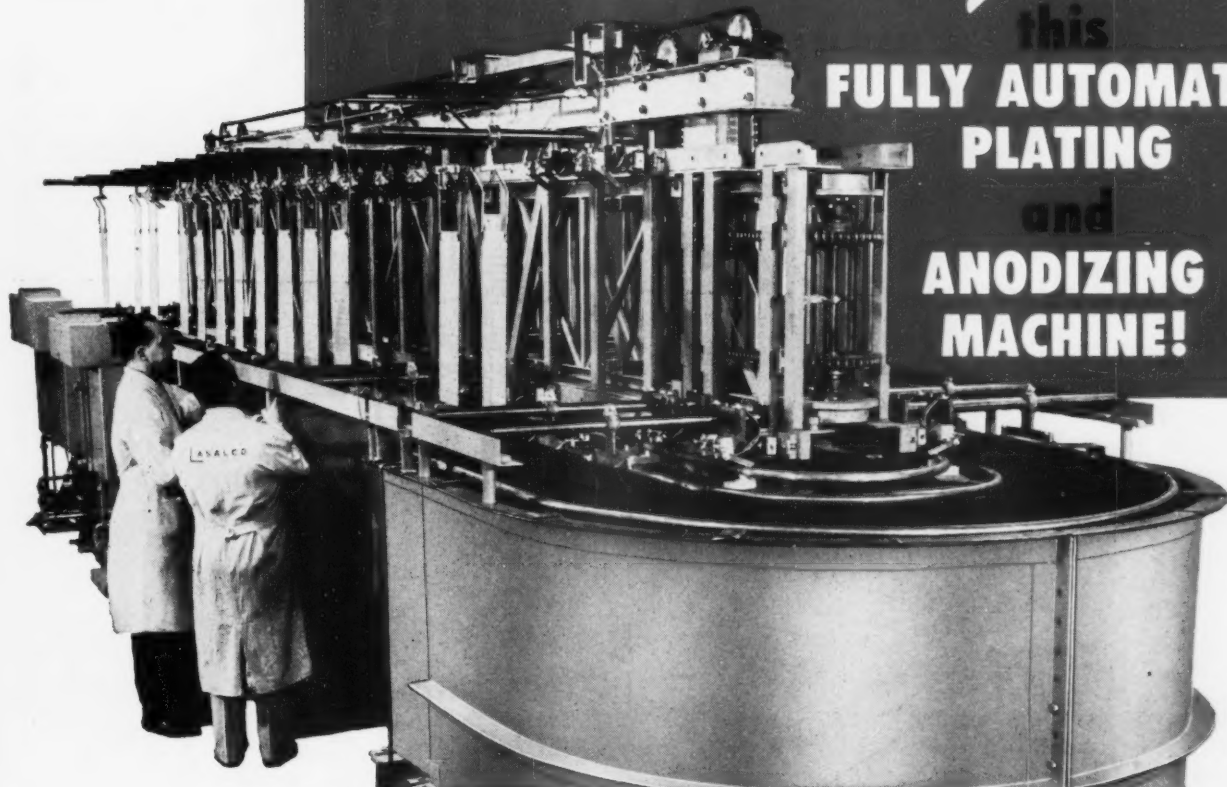
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WITH *Liquimatic*
"METERING"

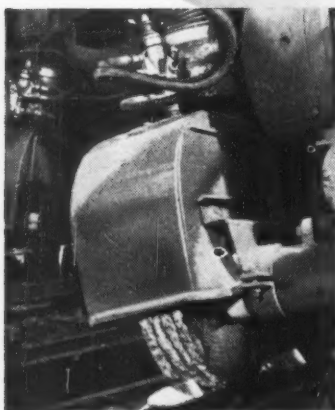
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Shipment can be handled in ☐ strapped bundles ☐ drums ☐ by rail ☐ by truck

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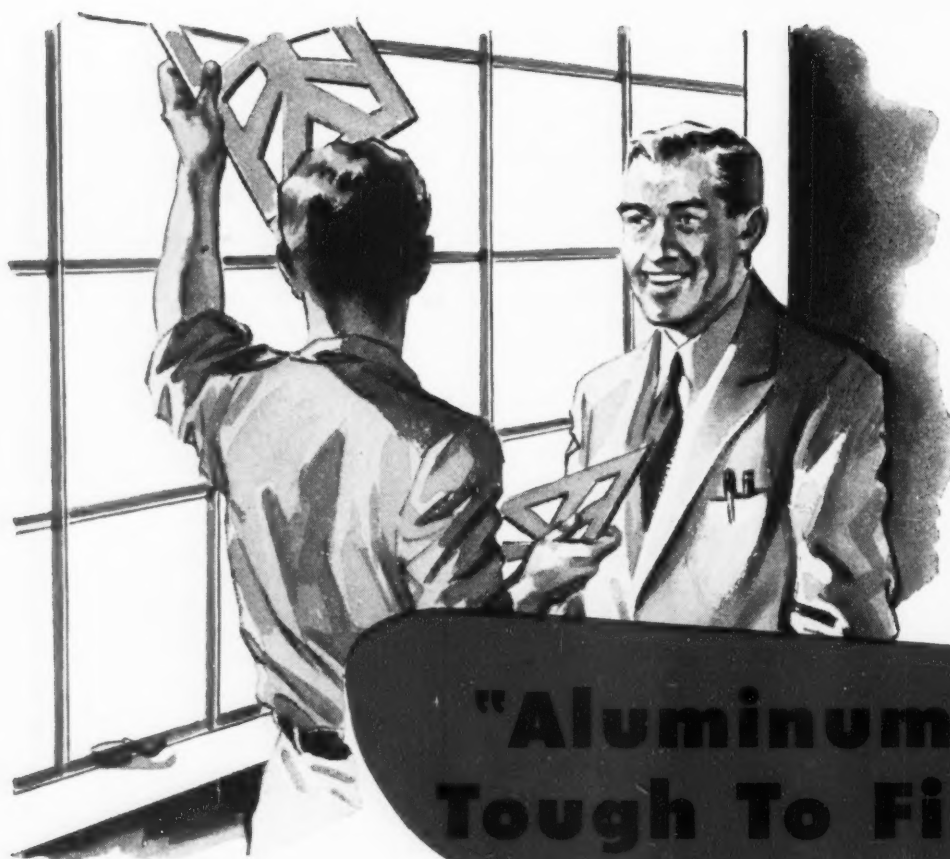
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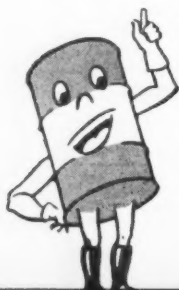


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... before Northwest developed these SPECIAL ALUMINUM CHEMICALS."

If you work with aluminum you'll be interested in Northwest's outstanding line of chemicals for use with modern alloys. Northwest's continuing research and development program has earned them the reputation of "First with the best" in this rapidly developing field. It will pay you to investigate:

Got a Problem?
Let our Cleaning
Specialists
help you!



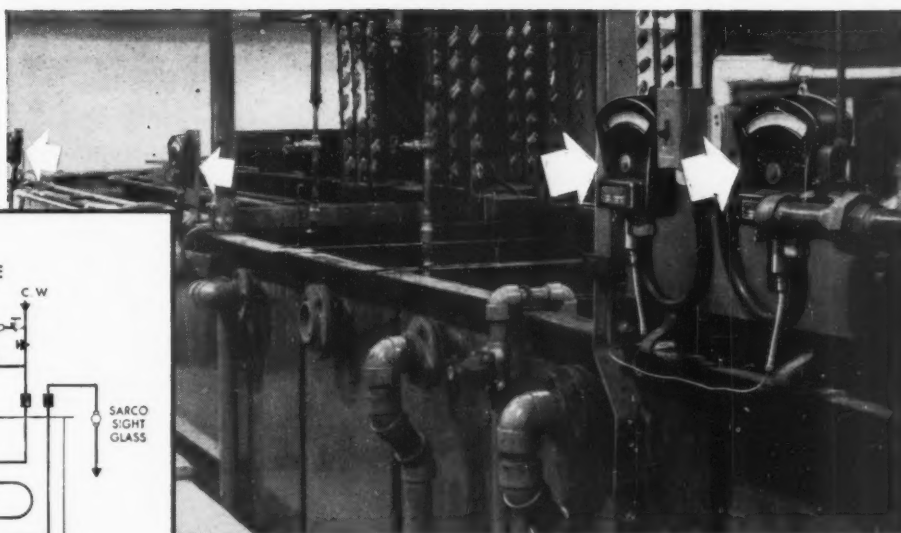
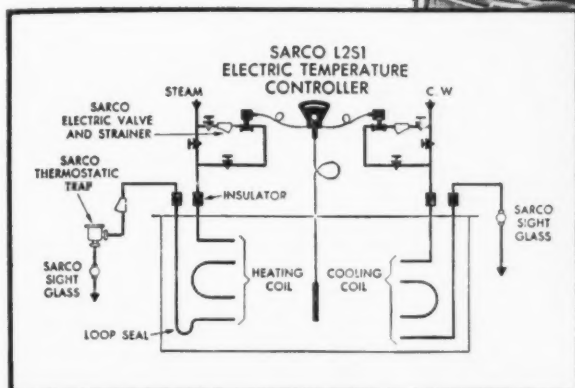
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- **ALKALUME PRE-PLATE**—An especially effective zincate bath for preparing aluminum for plating.
- **ACID SOLVENT EMULSION CLEANER No. 1**—An effective cleaner for fabricated aluminum parts before finishing.
- **DRAWING AND STAMPING COMPOUNDS FOR ALUMINUM**

NORTHWEST CHEMICAL PRODUCTS are manufactured on the West Coast by—

ALERT SUPPLY COMPANY
2041 South Davie • Los Angeles 22, California

NORTHWEST CHEMICAL CO.
9310 ROSELAWN DETROIT 4, MICH.





Seventeen Sarco Electric Temperature Controllers help maintain high quality plating—cut costs—at Ronson Corporation, Delaware Water Gap, Pa. Controllers are used on chrome, nickel, copper, silver, and gold plating tanks. This is a repeat installation.

Improve plating quality—cut your costs with low-cost temperature control

Unstable bath temperatures . . . the result of erratic manual temperature control . . . are sure to lead to costly rejects, wasted man-hours and breakdown of plating solutions.

You can solve these problems at *low cost* . . . by installing always-reliable Sarco Automatic Temperature Control. Just think . . . a complete Sarco System is yours for as little as \$130 a tank!

1. You improve plating quality because creeping temperatures are a thing of the past.
2. You lower rejects because solutions are held automatically to

pre-set temperatures. No chance for human error to mess up a tankload . . . and cut into profits.

3. You get better utilization of time—platers are able to concentrate on their plating work. No worrying about bath temperatures. No turning on and off of valves.
4. You save plating solutions—because automatic control prevents boil-off caused by overshooting temperature.

Write for Bulletin 1025-B or consult your plating supplies jobber. Sarco Company, Inc., 635 Madison Ave., New York 22, N. Y.



Sarco LSI Electric Temperature Controller

**A COMPLETE SYSTEM
FOR AS LITTLE
AS \$130 A TANK!**

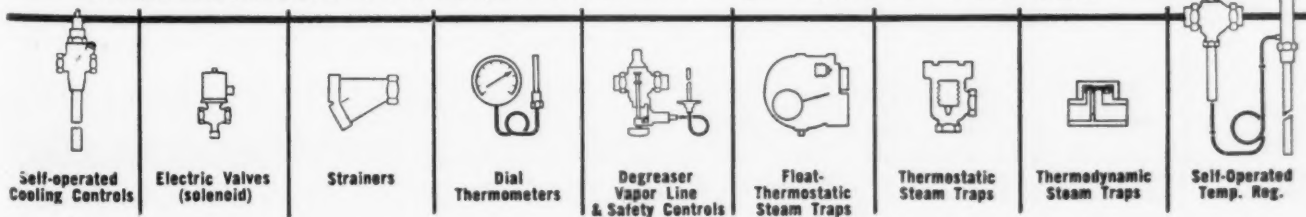
Think of it . . . automatic temperature control that often pays for itself in weeks!

Easy-to-read controller dial clearly indicates temperature being maintained. Temperature setting quickly changed by turning one knob.

SARCO

improves product quality and output

TEMPERATURE CONTROLLERS • STEAM TRAPS • STRAINERS



Quality

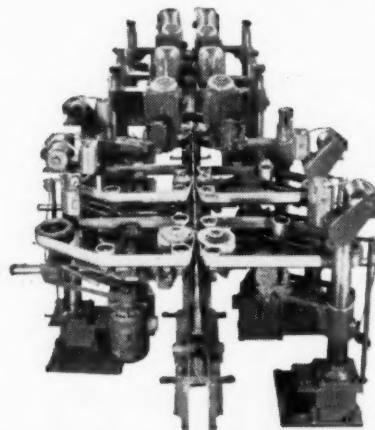
is consistent when you polish and buff

the *Acme* way!

Acme can build you a polishing and buffing machine to turn out part after part on schedule, and always with the same high quality of finish. That's why so many manufacturers turn to Acme to solve the tough ones.

Unusual contours or surface conditions won't stop Acme's specialized engineering talent—they'll build an automatic operation to handle it faster and cheaper. Maybe lack of space is your problem—Acme engineers working with flexible Acme standard units can often add to the number of operations on a single machine and eliminate the need for additional machines on the line. Or perhaps redesigning the indexing cycle to add more polishing or buffing heads on an existing machine can speed up production. Whatever your polishing and buffing problem is, the Acme man can help you.

Want proof? Send us your polishing and buffing problem and we'll give you our recommended solution in an Acme automatic machine.



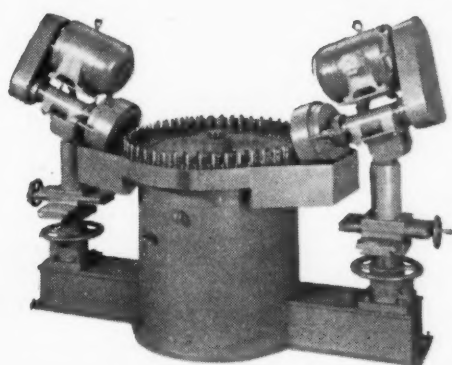
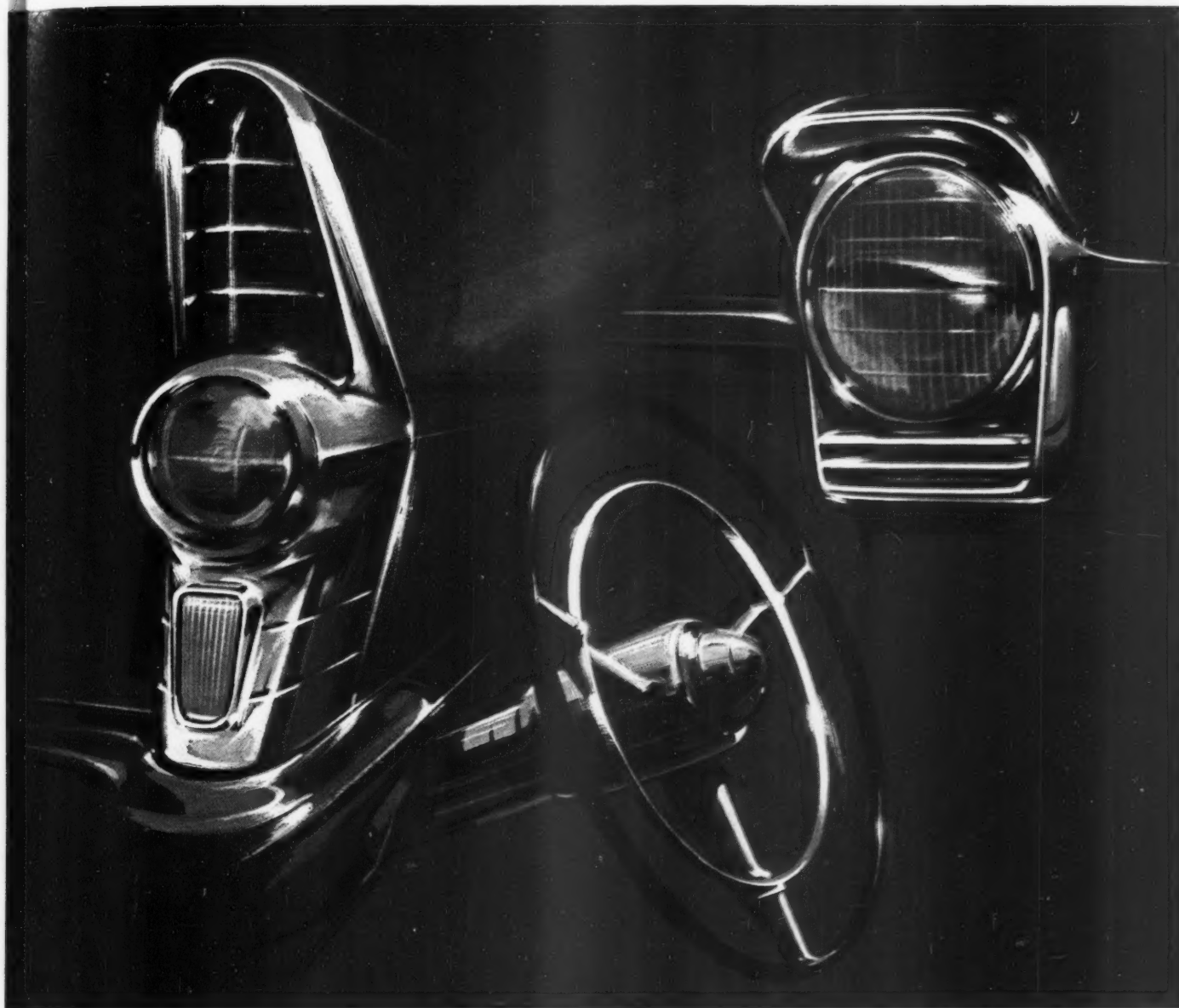
LET ACME *Polish Off*
YOUR FINISHING PROBLEMS

This Acme automatic straight-line machine with individual fixtures completely polishes and buffs upwards of 1,400 pieces per hour. Four Acme G-3 belt polishing heads with floating back-up wheel and vertical oscillation are followed up by eight Acme G-3 adjustable floating head buffing lathes.

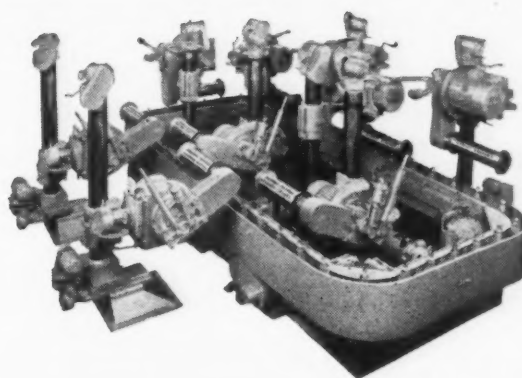
ACME MANUFACTURING COMPANY

LEADING PRODUCERS OF

METAL FINISHING, October, 1957



Extremely high volume can be put through this setup, for spot face grinding valve rocker arms. This Acme 36-inch continuous rotary table, with grinding wheel heads having cup wheels, can be quickly adapted to a variety of small castings.



An Acme rectangular polishing and buffing machine with eight Acme heavy-duty adjustable floating head lathes having 25-HP motors, equipped with 24" cartridge type spindles with remote control traverse feed on each head. Production can run several thousand pieces per hour.

1400 E. 9 MILE ROAD, DETROIT 20, MICHIGAN

AUTOMATIC POLISHING AND BUFFING EQUIPMENT SINCE 1910

METAL FINISHING, *October, 1957*

19/Circle on Readers' Service Card

19



(Photo courtesy of Chromium Corporation of America)

Reduce rejects — plate with Mutual low-sulfate chromic acid

When you chromium plate components like these cylinder liners for big diesels you can't risk a reject tag because the job didn't meet specifications.

One form of insurance against plating difficulties is MUTUAL Chromic Acid. Every drum is sampled and analyzed before shipment to make sure that it has a minimum assay of 99.75 per cent CrO_3 , and that

its sulfate content never exceeds 0.1 per cent.

Rigid quality control in the manufacture of MUTUAL Chromic Acid guarantees the uniformity of the product, making it easier for the plater to accurately control the chromic acid-sulfate ratio of his plating bath.

Mutual Chromium Chemicals



Sodium Bichromate
Sodium Chromate
Chromic Acid

Potassium Bichromate
Potassium Chromate
Ammonium Bichromate

MUTUAL CHROMIUM CHEMICALS
SOLVAY PROCESS DIVISION
Allied Chemical & Dye Corporation
61 Broadway, New York 6, N. Y.



Please send:

- ☐ Bulletin 52 — Chromium Chemicals — Their History, Properties and Uses.
- ☐ Bulletin 13 — Anodizing Aluminum by The Chromic Acid Process.

NAME _____ POSITION _____

COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

P2-9-1

Want to heat and cool plating solutions economically?

USE "KARBATE" BRAND IMPERVIOUS GRAPHITE



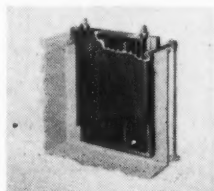
NEW! "KARBATE" Circulating Type Heat Transfer System — features proven "Karbate" Centrifugal Pump and "Karbate" Concentric Tube Heat Exchangers. Standard package units available immediately from stock provide from 4.1 to 35.2 square feet of heat transfer surface and circulating pump capacities from 20 to 100 gallons per minute.

Get information on these new units today!

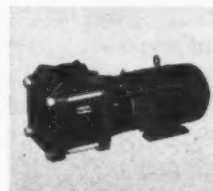
Call your Local Distributor or write us at the address below

Take advantage of the proven corrosion resistance, low cost and long life of "Karbate" brand impervious graphite in your metal finishing processes. National Carbon manufactures a complete line of standard "Karbate"

impervious graphite, including centrifugal pumps, shell and tube and concentric tube heat exchangers, plate and bayonet immersion heaters, armored pipe, fittings and valves. Complete literature and proposals on request.



"KARBATE"
Plate Type
Heat Exchangers



"KARBATE"
Centrifugal
Pumps



Sturdy, compact, with up to 55 sq. ft. surface area per unit. Recommended particularly for plating, cleaning, and similar tanks. Available from stock in number of standard styles and sizes — widths to 19", lengths to 94". Catalog Section S6620.

Available in a variety of sizes and models for all corrosive services, "Karbate" impervious graphite standard centrifugal pumps combine high efficiency and wide capacity range with outstanding mechanical design. Catalog Section S7250.

The terms "Karbate", "National" and "Union Carbide" are registered trade-marks of Union Carbide Corporation

NATIONAL CARBON COMPANY • Division of Union Carbide Corporation • 30 East 42nd Street, New York 17, N. Y.

Sales Offices: Atlanta, Chicago, Dallas, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco. In Canada: Union Carbide Canada Limited, Toronto.

A HOT IDEA FOR COOL PROFITS

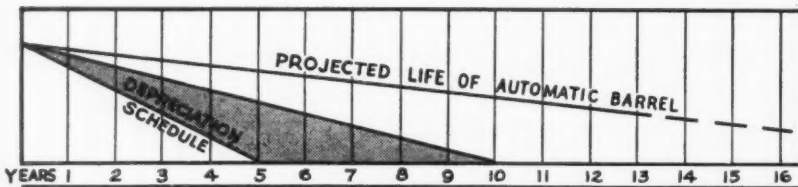


by A. B. HOEFER
Vice-President
FREDERIC B. STEVENS, INC.

THE FINISHING TOUCH

Stevens Automatic Plating Barrels Adaptable to Any Situation

IT'S GOOD TO KNOW WHEN YOU ARE INVESTING in a plating machine that Stevens units can be designed so that more than one type of plating can be done on one machine. Also, that changes can be made in the future to meet any specifications you may have. We've changed over a good number of Stevens machines in our time. That's why there are so many Stevens machines in use far beyond their depreciation schedule.



THERE ARE MANY OTHER SAVINGS you can enjoy beyond long life. Stevens Automatic Barrel machines require only one employee to operate the machine. These units are completely automatic, because the open end barrel is loaded when in a vertical mouth-upward position and automatically unloaded by tilting the barrel downward. There are no lids to fasten or unfasten.

POSSIBLE MIXING OF PARTS IS ELIMINATED in the Stevens automatic barrel. Small, special loads can be conveniently run without penalizing the productive capacity of the machine and without the inconvenience of partitioned cylinders. Stevens Automatic Barrel Machines are used for varied processes that include copper strike; copper, nickel, tin, brass, zinc and cadmium plating; phosphating; alrocing; dichromating; cleaning and bright dipping.

THE SIMPLE COMPACT DESIGN of this machine permits production capacities as high as 4,000 pounds per hour. Simplicity of design makes it equally practical to distribute the capacity between two or more machines to provide flexibility in plating thicknesses and production.

Let us give you more details on Stevens Automatic Barrels. Write us today, Frederic B. Stevens, Inc., 1814 Eighteenth Street, Detroit 16, Michigan.

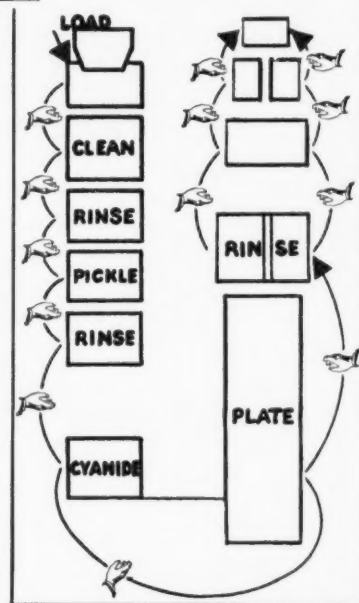


METAL FINISHING EQUIPMENT AND SUPPLIES
FROM CASTINGS OR STAMPINGS TO
FINISHED PRODUCT

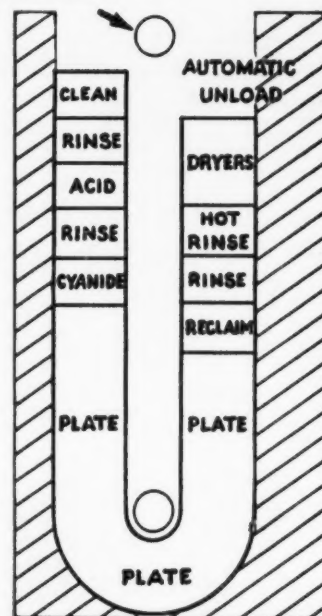
BRANCHES:
Buffalo • Indianapolis • New Haven
Offices in Principal Cities

HOW AUTOMATIC BARREL PLATING CAN REDUCE YOUR HANDLING AND BURDEN COSTS—

Compare this
Conventional Horizontal Barrel Line



With this
Stevens Automatic Barrel Installation



Production from both installations is the same.

Notice how many more handling steps (indicated by the illustrated hands) and manual load-unload operations (indicated by the arrows) are required for the manual set-up.

Notice, too, how much floor space (indicated by shaded area) is saved with a Stevens automatic installation. No manual operations required with automatic load and unload.



Formulators prefer Dow Alkali for efficient metal cleaning

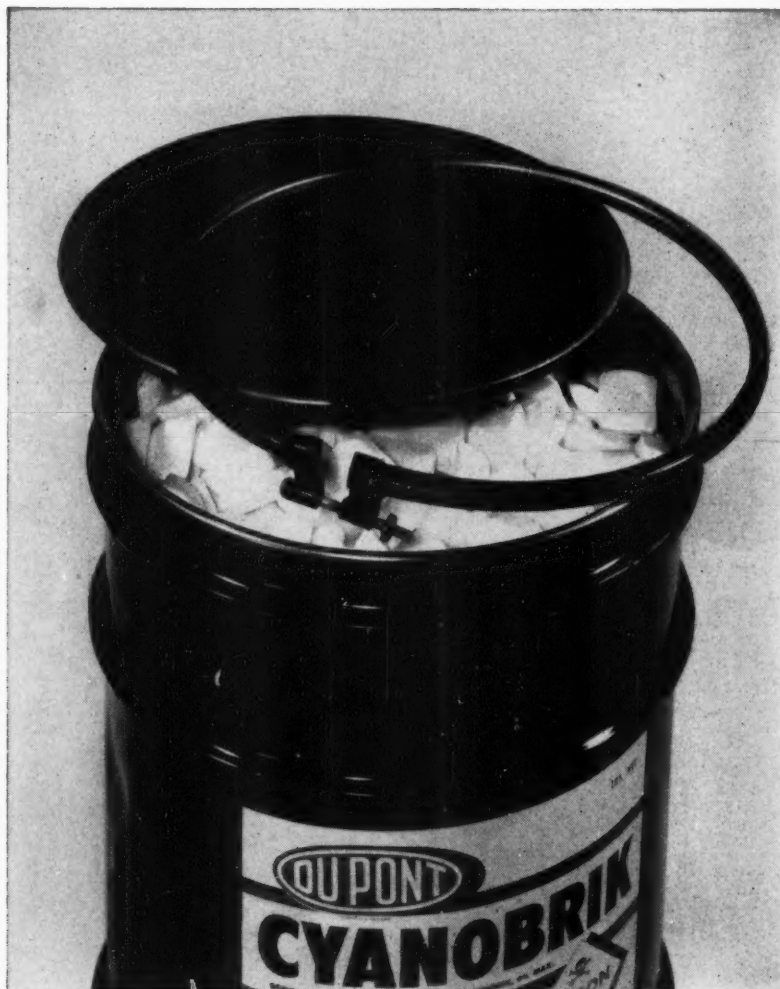
Formulators with know-how start with Dow Alkali as the base in their top-quality metal cleaning compounds. Why? Because Dow Alkali delivers the high cleaning power they need. Formulations containing Dow Caustic Soda Flake and Dow Sodium Orthosilicate clean fast and thoroughly,

leave metal parts and products free of dirt, grime and grease. Many plants have cut operating costs and increased efficiency by switching to a topnotch alkali cleaner made with Dow products. Why not give it a try? THE DOW CHEMICAL COMPANY, Midland, Michigan, Department AL607K-2.

YOU CAN DEPEND ON

DOW

*for your safety . . .
convenience . . .
and economy . . .*



Du Pont CYANOBRIK® sodium cyanide is packed in easy-to-open, reclosable drums

Just a few twists of a wrench unlock the full-open-head drums used to ship Du Pont Cyanobrik† sodium cyanide. Yet you can always count on receiving a dry, uncontaminated shipment because the airtight drum prevents moisture pickup en route . . . and is reclosable for full protection of partially used contents during storage.

Du Pont "Cyanobrik" has a negligible sulfide content—0.0005% or less by specification . . . making it most suitable for use in sulfide-sensitive plating processes.

You can count on prompt on-the-spot deliveries of high-test "Cyanobrik" from a dependable domestic source of supply. And, remember, our technical experts are always ready to give you assistance with any plating problem. Just contact your Du Pont distributor or get in touch with us at the address below.

†REGISTERED TRADEMARK



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

ELECTROCHEMICALS DEPARTMENT
Sodium Products Division

E. I. DU PONT DE NEMOURS & CO., INC.
Wilmington 98, Delaware

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*Barada & Page, Inc.



FULL TREATMENT

to give you the
most efficient, economical
power you can buy

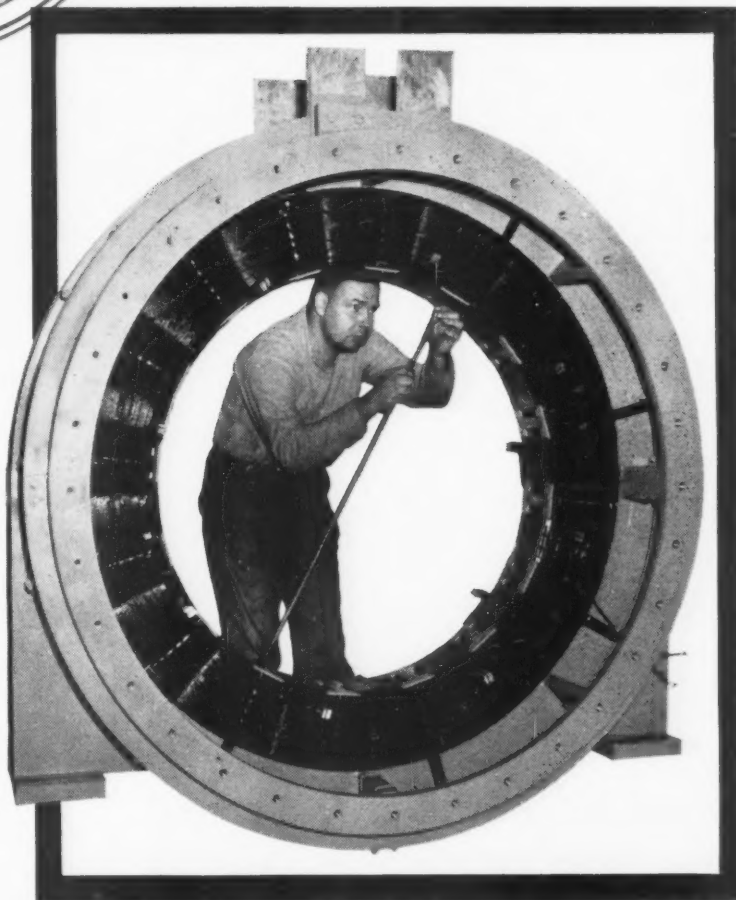
Chandeysson

**assures long life,
lower maintenance costs
—by far**

All poles on Chandeysson Generators are micrometer accurately positioned to assure sparkless commutation and long brush life, 20,000 hours on the average. Even when brushes need to be replaced . . . and brushes are the *only* replacement item in a motor-generator set . . . they represent only 2% of the initial cost of the set, as compared to 25% for replacement of comparable equipment in other forms of power conversion.

This is just one example of Chandeysson *performance* engineering. Behind every generator are decades of engineering and manufacturing know-how . . . consistent employment of only the finest, most durable materials . . . and user testimony to highest standards of performance and life-long service. For extra capacity to meet emergencies at the lowest possible cost . . . whatever your needs are in power conversion equipment . . . insist on Chandeysson low-voltage generators.

GET ALL THE FACTS on how you can gain life-time power dividends with a Chandeysson Motor Generator set. Mail this coupon . . . Now!



CHANDEYSSON ELECTRIC COMPANY
4074 Bingham Avenue, St. Louis 16, Mo.
Please send new booklet D-103

CHA-90

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

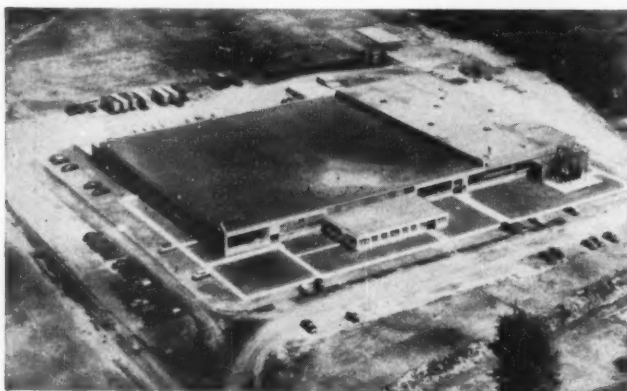
CHANDEYSSON ELECTRIC COMPANY • 4074 Bingham Avenue, St. Louis 16, Missouri

\$2,000 a Month Saved By Channel Master!

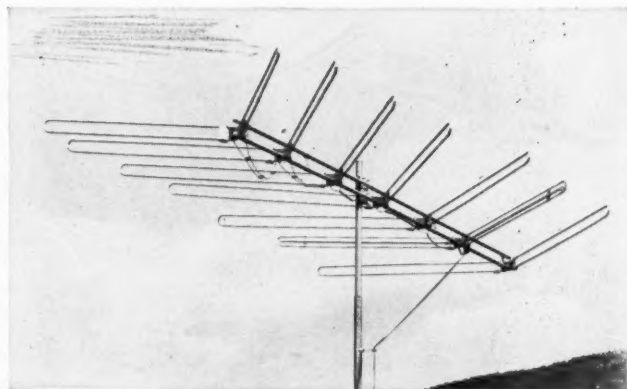
By Using Ion Exchange To Purify Chromic Acid Bright Dip

Channel Master Corp., of Ellenville, N. Y., is the world's largest manufacturer of television antennas and accessories. One important reason for this leading position in a new and highly competitive field is the extremely high quality they have set for all their products.

One of these standards requires that the antenna withstand the corrosive effects of weather during its years of service. Although the antennas are primarily made of aluminum, steel clamps used in assembly can be affected by weather. In order to protect these steel parts and other vital accessories, such as mounting brackets and insulating hardware, from corrosion, they are first zinc plated and then dipped in a chromic acid type bath and sent through rinsing



Channel Master's modern plant located in the heart of New York's resort area



Channel Master TW fringe area antenna.

and bleaching baths to give them a bright finish. The bright dip bath loses its bite rapidly — affecting quality and requiring either discharge or treatment.

Channel Master thoroughly investigated all known methods of treatment to find the one most suitable for their needs. They finally chose a Graver Ion Exchange system tailored to fit into the overall plating operation. This system restores the original bath quality and eliminates bath dumping. The equipment has now been in operation for over two years.

Results

- \$2,000 a month saved by Channel Master using Graver Ion Exchange
- Difficult waste disposal problem solved
- Better rinsing from demineralized water



Write for Technical Reprint T-143 describing the operation of above system and Bulletin WC-111 describing Graver Ion Exchange Systems.

Industrial Waste Dept. W-511

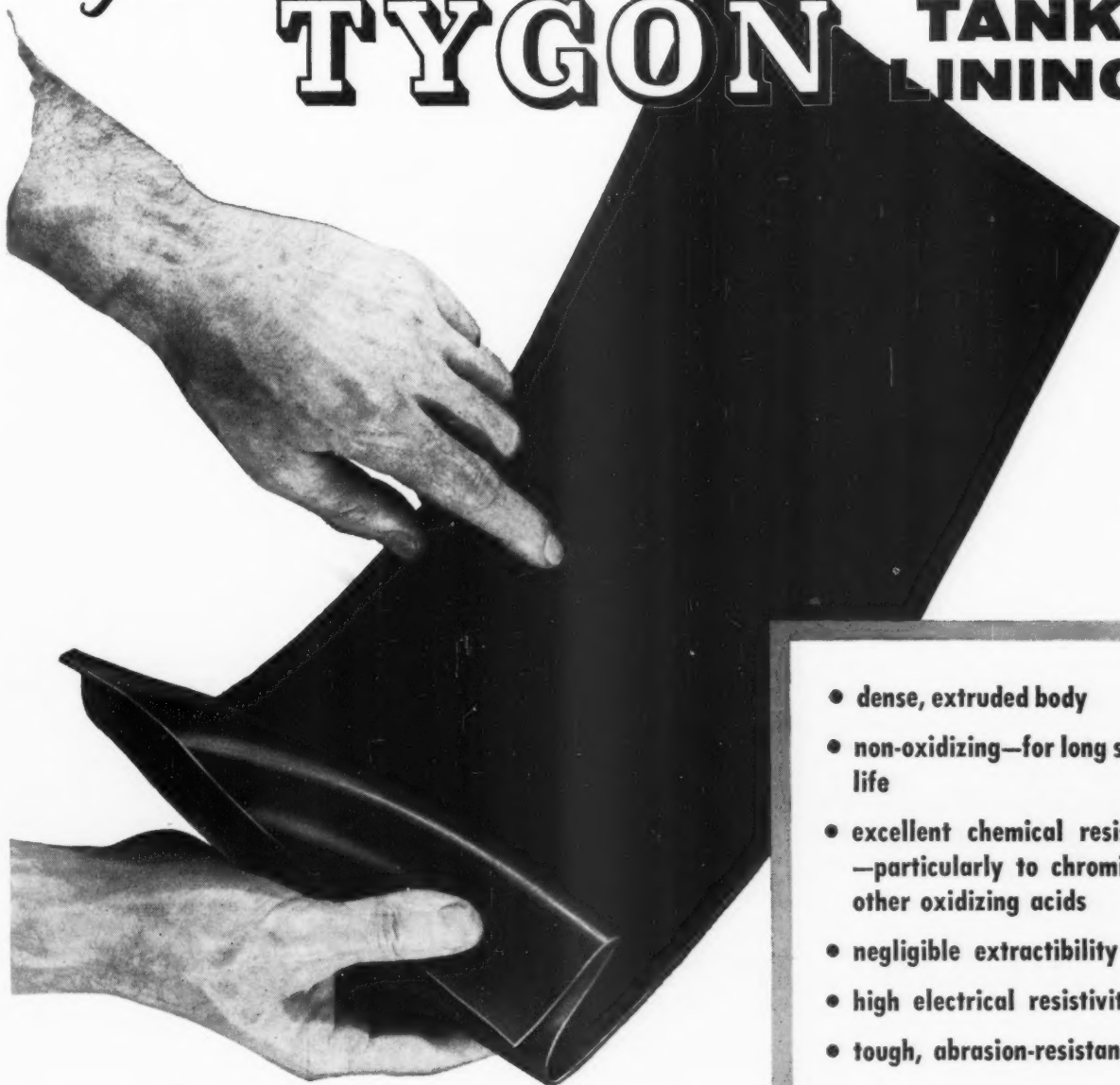
GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

216 West 14th Street, New York 11, N. Y.

A new

TYGON TANK LINING



- dense, extruded body
- non-oxidizing—for long service life
- excellent chemical resistance—particularly to chromic and other oxidizing acids
- negligible extractibility
- high electrical resistivity
- tough, abrasion-resistant

This new Tygon tank lining material (Formulation 105A) represents a major step forward in the development of plastic linings for corrosive service. This new lining is *extruded*, not calendered. It is completely free of laminations, hence no "peeling" in service. It shows excellent resistance to highly oxidizing acids, including chromic.

103-F



Tygon Tank Linings can be installed at our plant or in the plants of licensed fabricators throughout the United States and Canada. Write today for Bulletin TL-526R.



U. S. STONEWARE
AKRON 9, OHIO

SHAPED, EXTRUDED ANODES



THE GREATEST ANODE DEVELOPMENT IN YEARS

APW Shaped, Extruded Anodes were developed to extend the useful life of our anodes . . . to assure uniform and consistently smooth electrodeposits . . . to minimize shedding. They accomplish these objectives for our customers day after day—and in addition, *they have helped to lower plating costs!*

The anodes are scientifically shaped to retain 80% of original surface area after 85% by weight has been plated off! You get longer anode life, minimized polarization and less silver scrap to be refined.

The APW Extrusion Process* assures small, uniform grain size controlled between definite, ideal limits. Corrosion is smooth, shedding is virtually eliminated, rejects are a comparative rarity.

Be certain the silver you buy in anodes is used most efficiently and economically. Our service department will be glad to develop special anode shapes to meet your particular plating bath conditions. Call or write for a representative, we'll be glad to assist with your anode problems. ★ ★ ★ ★ ★

* Pat. Pending

THE AMERICAN PLATINUM WORKS
231 NEW JERSEY RAILROAD AVENUE • NEWARK 5, NEW JERSEY

ENGELHARD INDUSTRIES



It's NEW . . . It's PROVEN!

ROHCO® 503 ZINC BRIGHTENER

FOR STILL AND AUTOMATIC PLATING

STABILITY

ROHCO 503 resists break-down at high temperature, giving peak economy of operation — generally 50,000 or more ampere-hours per gallon.

BRIGHTNESS

Uniformly high luster, from high current densities into the deepest recesses.

COVERING POWER

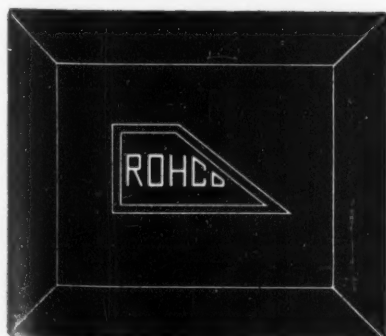
Helps coverage in deep recesses or on high carbon steels.

FINE GRAIN

For maximum luster, corrosion resistance, and acceptance of chromate conversion coatings or black finishes.

ROHCO 503 is a balanced liquid formulation that has been tried and proven in 150,000 gallons of zinc solution. Remember, ROHCO analytical service and technical representatives are available for assisting you in conversion or any other plating problems. Send coupon for further details!

R. O. HULL & COMPANY, INC., 1301 Parsons Ct., Rocky River 16, Ohio



JUST PIN THIS COUPON TO YOUR LETTERHEAD

R. O. HULL & COMPANY, INC.
1301 Parsons Court
Rocky River 16, Ohio

- ☐ Send information on ROHCO 503 ZINC BRIGHTENER
☐ Have representative call.

Name Title

Company

Street Address

City Zone..... State.....

Facts to consider when you're buying

Chromate Conversion Coatings

for Corrosion Protection, Paint Base, Decorative Finishing

WHAT IS IRIDITE®

Briefly, Iridite is the tradename for a specialized line of chromate conversion finishes. They are generally applied by dip, some by brush or spray, at or near room temperature, with automatic equipment or manual finishing facilities. During application, a chemical reaction occurs that produces a thin (.00002" max.) gel-like, complex chromate film of a nonporous nature on the surface of the metal. This film is an integral part of the metal itself, thus cannot flake, chip or peel. No special equipment, exhaust systems or specially trained personnel are required.

If your company is manufacturing or buying parts or complete assemblies made from or plated with any of the more common non-ferrous metals—zinc, cadmium, aluminum, magnesium, silver, copper, brass or bronze—you've probably already run up against the question of finishing these surfaces with a chromate conversion coating. These coatings are used to protect against corrosion, or to provide a base for paint or to provide a decorative finish for sales appeal or shelf life. Since chromate conversion coatings represent a relatively new means of obtaining these finishes, this digest of facts to consider may be of value to you.

1. THE COATINGS THEMSELVES.

There are many brands on the market. All are similar in many ways. Each, of course, offers its own specific advantages and these may relate to operating techniques, performance under actual use conditions, cost, availability, etc. Naturally, you'll want to choose a coating that is widely known and accepted under both military and civilian specifications.

2. THE COMPANY BEHIND THE PRODUCT.

Is it a reliable, established organization? Does it offer experienced technical service, both from the field-engineering organization as well as the home office and laboratories? The man who sells and services your installation should be thoroughly familiar with not only chromate conversion coatings and their applications, but also with the characteristics and performance of related finishing operations such as pre-cleaning, electroplating, painting, etc. This is most important since all steps of the finishing cycle must be functioning properly for the satisfactory performance of the ultimate finish produced.

3. AVAILABILITY OF THE PRODUCT.

Ideally, of course, the material should

be readily available to you from nearby warehouses to avoid time loss in long distance shipping and to provide emergency service, should the need arise.

4. COST. Naturally, the initial price of the material is important to you. However, just as you consider ultimate cost when you are buying mechanical equipment, ultimate cost must be considered for these finishing chemicals. So, it will pay you to investigate consumption costs, labor costs and the other factors which go into the determination of ultimate cost. Further, cost alone gives no indication of product performance, so careful attention must be given to the purpose the finish must serve and the value that finish will add to your product.

5. FACILITIES FOR RESEARCH AND DEVELOPMENT. Perhaps the existing types of chromate conversion coatings do not include a compound that will accomplish exactly what you wish. Then, it is important to deal with a supplier who has adequate research and development facilities available to work with you to produce a material to meet your needs. Naturally, such a project is seldom completed overnight. But, with complete cooperation and confidence from both you and your supplier, chances are a satisfactory program can be completed.

These are the concepts of sales and service on which we, Allied Research

Products, Incorporated, have developed and marketed the line of Iridite chromate conversion coatings...superior product performance, complete sales and technical service, easy product availability, economical cost, extensive research and development facilities. No doubt you are familiar with our line and have seen this trademark—

IRIDITE®

—in our advertising, technical literature or on shipping containers in your plant. Remember this trademark when you're buying or investigating chromate conversion coatings for your company. It's your assurance of quality, economical products from a reliable and established company, skilled sales and technical service from both our home office and a national network of representatives, immediate availability from warehouses in strategic industrial areas and our willingness to work with you to develop new finishes to meet your needs, should the present line fall short.

For complete information on Iridite chromate conversion coatings, write today for your free copy of our technical data file. Or, for immediate advice, call in your Allied Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

ALLIED RESEARCH PRODUCTS
INCORPORATED

4004-06 E. MONUMENT STREET • BALTIMORE 5, MD.

Manufacturers of Iridite chromate conversion coatings for corrosion resistance, paint systems, final finishing of non-ferrous metals; ARP Plating Brightener & Chemicals. West Coast Licensee—L. H. Butcher Co.

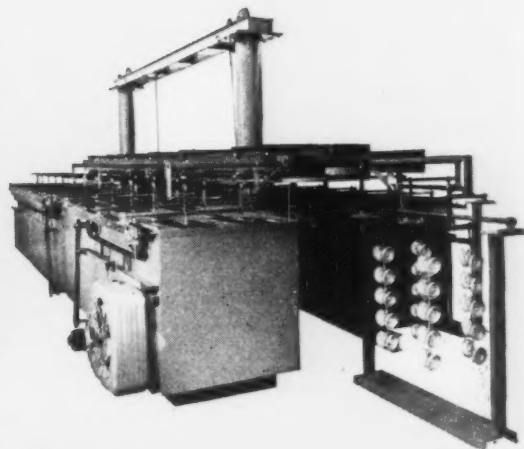
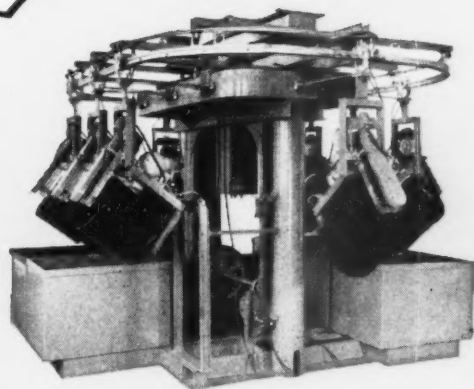
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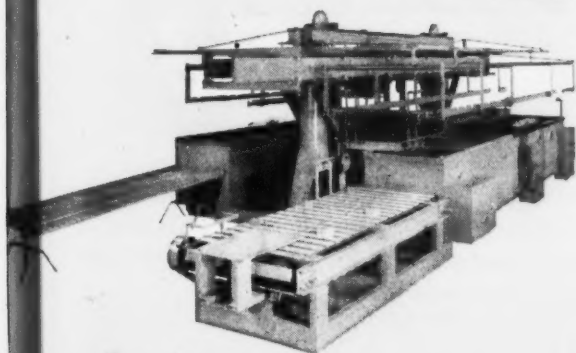
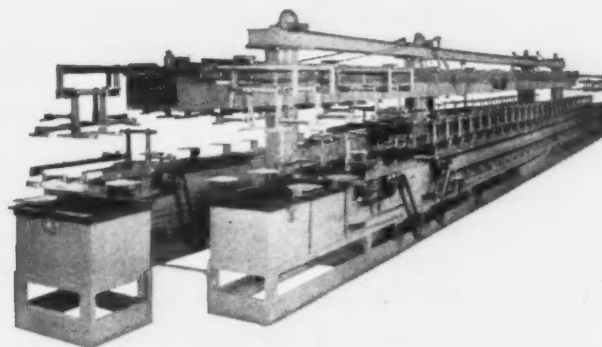
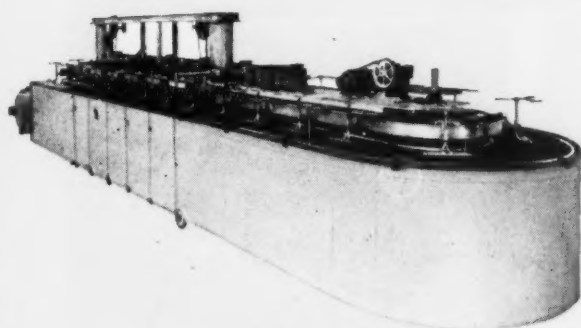
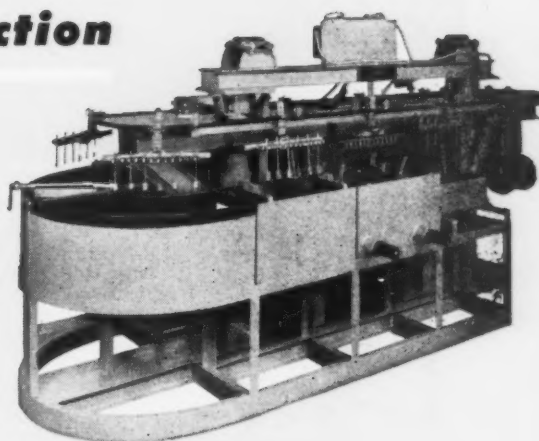
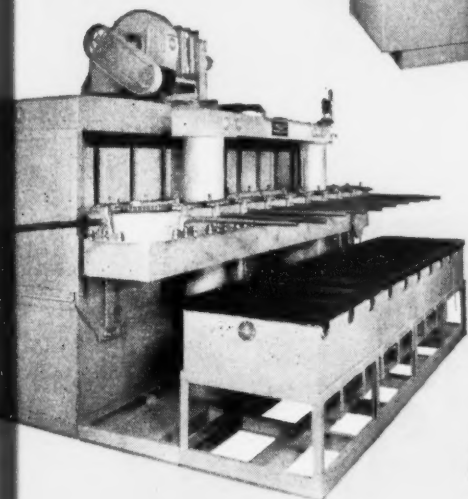
CROWN AUTOMATICS



increase production

reduce costs

improve quality



Crown Automatics are ideal for plating your barrel or racked work. Crown manufactures the widest variety of fully automatic plating machines in the industry... there is a model to fit your needs. Write us details of your job and production requirements.

CROWN RHEOSTAT AND SUPPLY COMPANY

3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS



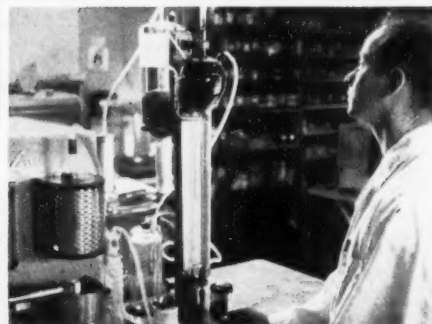
"Al, you must be crazy..."

"A few years ago we decided to make our Quality Control Lab as good as could be found anywhere. We staffed it with first rate people and bought the latest in equipment including the finest Spectrographic Instrument available. At this point, our accountant — you know the type — a nice enough guy, but never happy unless he's shaking his head and wiggling his fingers at you . . . said to me, 'Al, you must be crazy, putting all this money into Quality Control.'"

"Well, it took a lot of doing—and plenty of dollars, but it was worth it. We've grown steadily and it sure is a nice feeling to know that many of our regular customers include the finest platers in the country."

Al Kerzner

AL KERZNER, President



Illustrated are several views of our all new Wet and Spectrographic Laboratories, including some of the finest quality control equipment available.



If you're a user of Copper, Nickel or Zinc Anodes, and if quality (at a competitive price) is an important factor to you, contact us! We manufacture them in a variety of sizes and shapes, and we can make them to your specifications.

NEW JERSEY METALS COMPANY 720 Rockefeller St., Elizabeth 2, N. J.

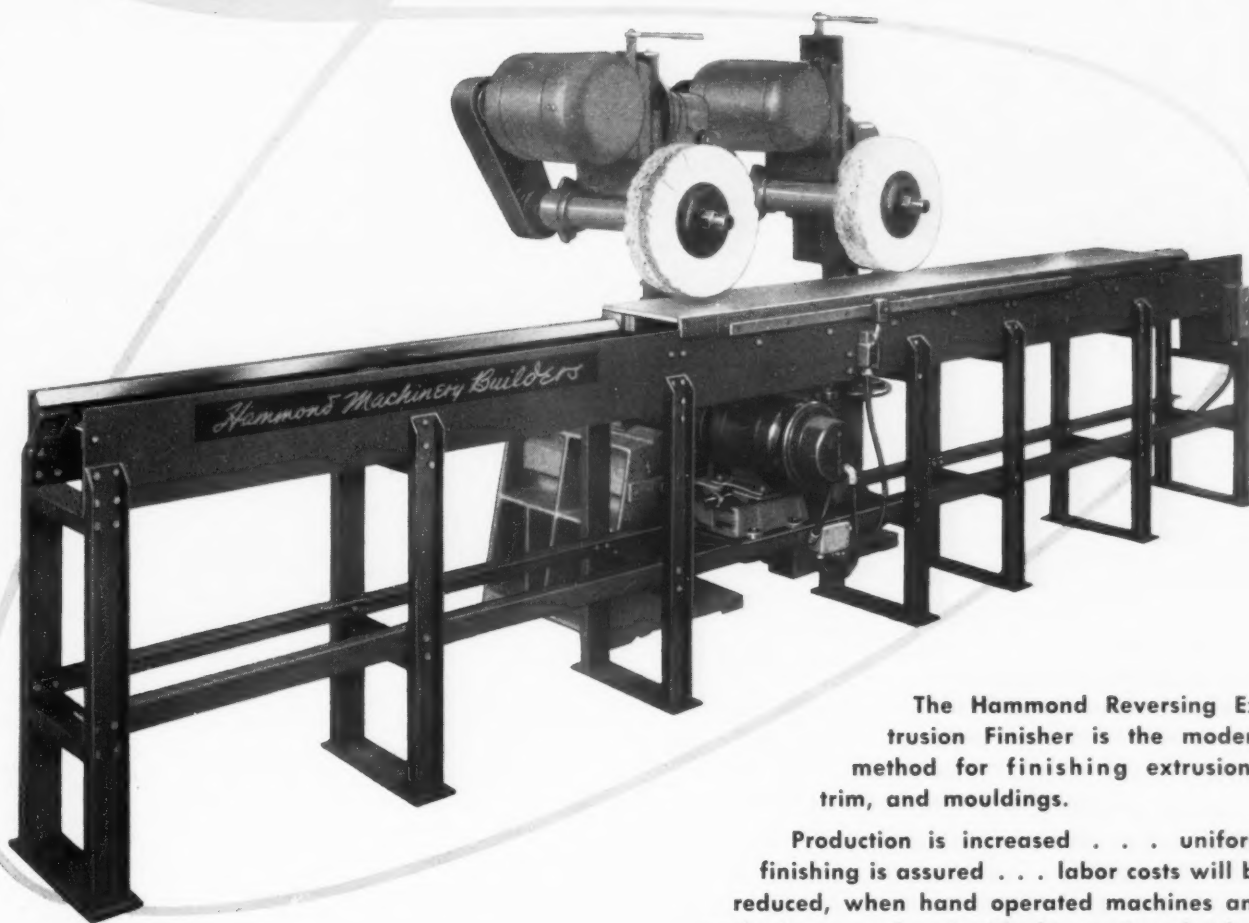
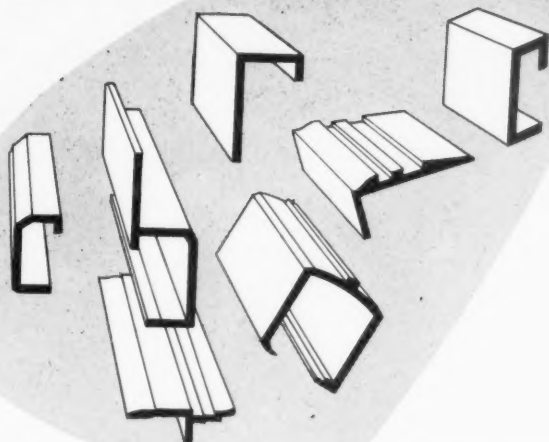
Serving Industry from Coast to Coast — since 1920

ELizabeth 4-6336

Hammond
OF KALAMAZOO

REVERSING *EXTRUSION* FINISHER

for LOW COST, VOLUME PRODUCTION
FINISHING OF EXTRUSIONS,
TRIM AND MOULDINGS



Two-Head Machine shown . . . any number of heads, and length of conveyor, can be supplied to suit your job.

The Hammond Reversing Extrusion Finisher is the modern method for finishing extrusions, trim, and mouldings.

Production is increased . . . uniform finishing is assured . . . labor costs will be reduced, when hand operated machines and methods are replaced with this modern finisher.

SEND SAMPLES and we will show you how much you can speed up production and cut costs.

Hammond Machinery Builders
INC.

1601 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

SEE US IN OPERATION, BOOTH 1311, NATIONAL METAL EXPOSITION, NOV. 4-8

Wheels coated with **ALUNDUM** abrasive give housing covers a fine polish, faster and for less money — like other Norton "Touch of Gold" grains that cover the widest range of polishing operations. ►



Setting up the wheels shown at right is an easy job. The high capillarity of **ALUNDUM** polishing grains improves and speeds up the wetting process with glue or cement.

How polishing costs are being cut...NOW

*Trend to wheels set up with **ALUNDUM*** abrasive is spreading the money-saving "TOUCH OF GOLD"*

Many plants where polishing jobs are important find that a change-over to wheels set up with Norton **ALUNDUM** abrasives results in better, faster, lower-cost polishing.

In particular, preferences for S and R type grains are increasing rapidly. The S type, available in 14 to 90 grit sizes, is specially surface-treated to give the abrasive much greater adhesion to glue or cement. The R type, made in 100 to 240 grit sizes, also gets a special surface treatment, to improve its adhesiveness for use with glue only.

Typical advantages common to all **ALUNDUM** polishing grains include:

- **Uniform grain shape**, that assures a fast, uniform cutting action.
- **Uniform grain sizings**, with no oversize grains that mar the finish, no undersize grains to loaf on the job.
- **High capillarity**, assuring the easy absorption of adhesive that means longer lasting, better performing set-up wheels.

The booklet "Setting Up Metal Polishing Wheels and Belts" contains valuable facts on the various types of

ALUNDUM grain . . . on the applications of canvas, leather or wooden wheels . . . and on the best means of preparing wheels, with cement or glue. Ask your Norton distributor for it. Or write to **NORTON COMPANY**, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

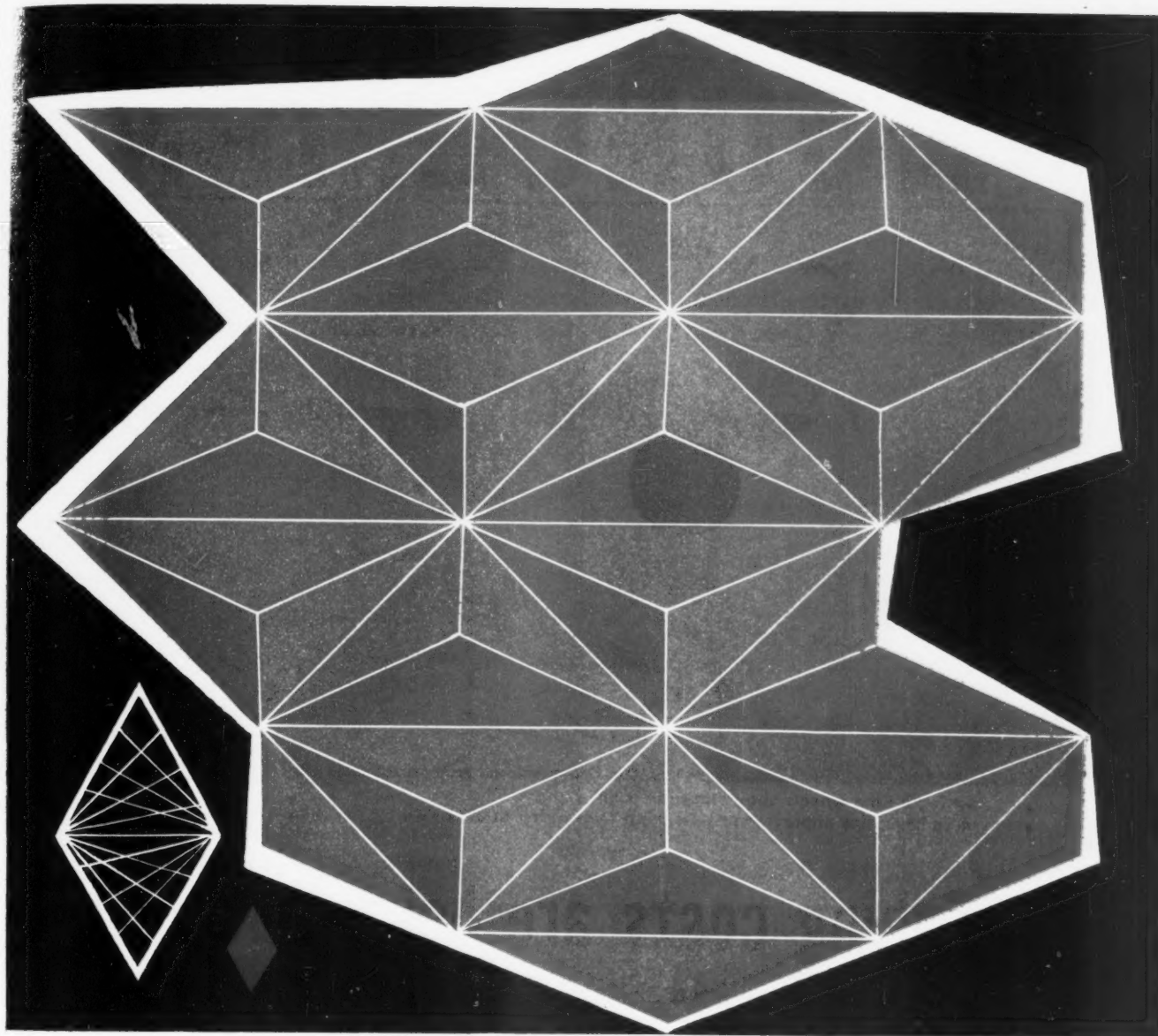
*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries
G-334



NORTON
ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS
Abrasive • Grinding Wheels • Grinding Machines • Refractories
BEHR-MANNING DIVISION
Coated Abrasives • Sharpening Stones • Behr-cat Tapes



SANDOZ DYES
CREATE
A COLORFUL FUTURE
FOR ALUMINUM



*Only from Sandoz . . .
all these extra values in colors for anodized aluminum:*

- ★ dyes that command confidence—because they have proved their worth in production anodizing
- ★ reliably standardized dyes in every color with sales appeal
- ★ immediate technical service on color anodizing problems
- ★ samples by return mail or—at need—by special delivery. Orders shipped the same day from District Offices in Hudson, Mass., New York City, Philadelphia, Cincinnati, Charlotte and Los Angeles
- ★ up-to-date technical data on color anodizing, backed by a continued promotional program to increase uses of dyed aluminum

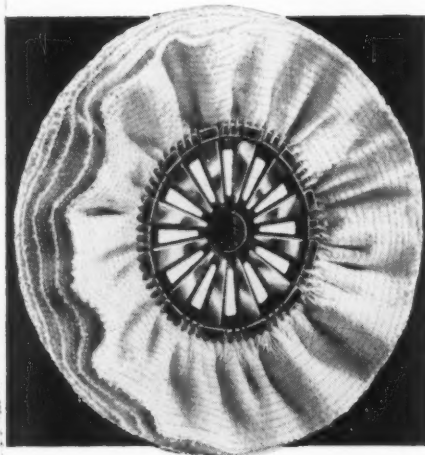
In copper dyes—standard colors or special formulas:

In coppers, the shade can be easily controlled for maximum eye appeal. The Sandoz “copper shades” range from a reddish hue to an antique metallic tone of weathered copper. Wouldn’t you like to have more to offer in copper? Call us today.

SANDOZ, INC., 61-63 VAN DAM STREET, NEW YORK 13, N. Y. ALGONQUIN 5-1700

IMPORTANT ANNOUNCEMENT

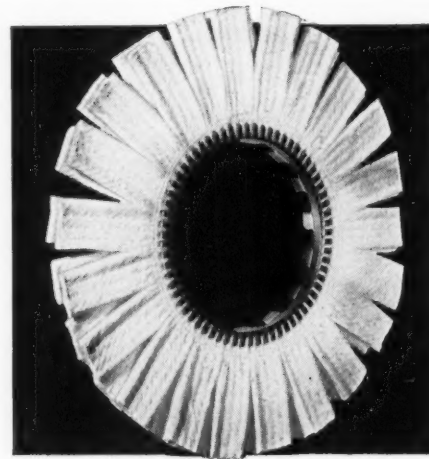
The *American Buff Company* announces the granting of patents by the United States to cover their new, improved Unit Sisal Buff and Open Face Combination Cloth and Sisal Bias Buff.



COMBINATION CLOTH and SISAL BIAS BUFF

United States Patent No. 2,803,097

- Gives the rapid coarse-cutting quality of a polishing wheel and the smooth luster-imparting ability of a soft cotton buff.
- Special construction prevents unravelling yet has the flexibility needed for irregular or contoured surfaces.
- Special design provides the ventilation required to prevent overheating.
- Multi-purpose construction makes substantial savings in time, labor and materials.



UNIT or FINGER SISAL BUFF

United States Patent No. 2,803,096

- Combines all of the desirable features of a cloth buff and a sisal buff.
- Gives high cutting rates with a finish of high luster and color.
- Extra flexible for fast cutting and finishing on irregular and contoured surfaces.
- Utilizes finger construction to assure cool operation.

American Buff Company believes that the buffs disclosed and claimed in these patents constitute valuable additions to the buffing art. So that the buff industry may obtain the full benefit of these types of buffs, we are offering to grant non-exclusive licenses under either or both of these patents, at a reasonable royalty, to manufacturers who wish to make and sell products embodying these inventions. Infringements will be fully prosecuted.

"FOR THE JOB THAT'S TOUGH, USE AN AMERICAN BUFF"

American Buff Company
2414 S. LaSalle St. Chicago 16, Ill.



News about COATINGS for METALS

Metallic.....Organic.....Decorative.....Protective

New M&T bright cyanide copper — faster and more economical

Copper deposits now fit the need

Metal & Thermit now offers the most complete line of copper plating processes — has a deposit to meet all applications.

M&T "Golden Glow" Bronze is recommended for the optimum in speed, or throwing power to cover the most intricate work, or for a most attractive final finish. This is a copper-tin alloy process that is as easy to control as single metal plating.

Unichrome Pyrophosphate Copper stands out when density of deposit and smoothness are primary. It is preferred for such jobs as stop-off in nitriding, and for printed electrical circuits.

M&T Bright Cyanide Copper offers mirror brightness and excellent plating speed as an undercoat for decorative chromium finishes.

Bulletins available on each.

Unichrome is a trademark of Metal & Thermit Corp.



METAL & THERMIT CORPORATION

General Offices: Rahway, New Jersey
Pittsburgh • Atlanta • Detroit
East Chicago • Los Angeles
In Canada: Metal & Thermit—United Chromium
of Canada, Limited, Rexdale, Ont.

Metal & Thermit bath uses entirely new addition agents for stability, more dependable operation

Users report that the new M&T Bright Cyanide Copper reduces operating costs and assures uniformly high plating quality with a minimum of control. The low cost solution can be made up with potassium, sodium, or a combination of the two salts.

The cost of operation is low due to long life and stability of the addition agents.

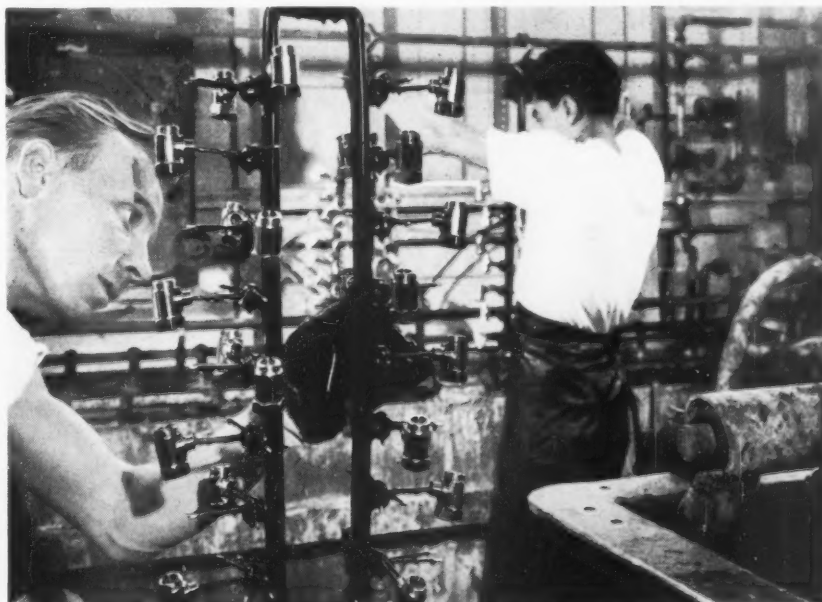
The deposits may be mirror-bright, if desired, or of a lesser degree of brightness, depending upon the specific requirements of each installation. The stability of the so-

lution has enabled platers to obtain brighter deposits with greater consistency than ever before.

A wide bright range at high cathode efficiency assures high rates of deposition without burning on edges or dullness in recessed areas. High current densities may be used.

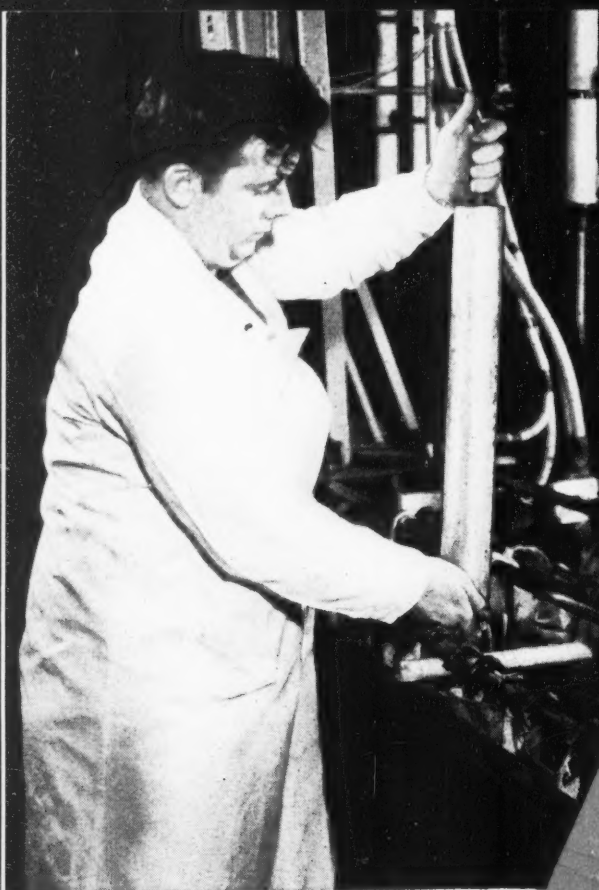
The process provides excellent anode corrosion, utilizing a new bath additive, NEOCHEL, which replaces Rochelle salts. The exceptional stability of this and other additives assures freedom from difficulty due to the accumulation of decomposition products in the bath.

Process control has been simplified. Only one chemical determination and a single Hull Cell test are required for control of the additives.



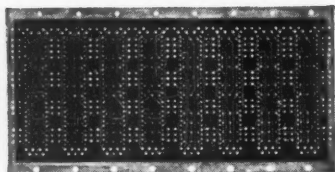
M&T Bright Cyanide Copper Process is already at work in sizable installations and a proved success.

Photo courtesy Pottstown Plating Works, Inc.



PLATING THROUGH HOLES

**PHOTOCIRCUITS CORP.
USES OFHC® COPPER ANODES
TO CUT FIELD REJECTS
BELOW 0.01%**



Printed circuits consist of electrically conductive patterns bonded to an insulator base. They are widely used to cut down the miles of hand wiring and hand soldering of wires and components in the electronics and avionics industries. For plated-through holes in printed circuits, Photocircuits deposits 0.002-inch copper followed by approximately 0.001-inch solder or 0.0005-inch silver.

Plated-through holes make the best electrical connections between two sides of a printed-circuit board—if there is *uniform plating coverage* of the hole. That's why Photocircuits Corporation, a major designer-manufacturer of printed circuits, copper-plates *exclusively* with OFHC Brand Copper Anodes.

Photocircuits plating men found that conventional copper anodes require costly techniques for uniformly plated-through holes. But with OFHC Copper Anodes, accelerated and simplified procedures became feasible—with such good results that rejects for plated-hole failure in the field are now less than 1 in 10,000.

OFHC Copper Anodes give more uniform plating because OFHC Copper—produced exclusively by AMCO—is free of anode impurities. OFHC Copper is 99.99+% pure, contains no oxides, no deoxidants.

To find out how the extreme purity of OFHC Copper Anodes can benefit your own electroplating operation, contact your distributor or our nearest office directly.




THE AMERICAN METAL CO., LTD.

61 Broadway, New York 6, N. Y.

BOSTON — CHICAGO — DETROIT — LOS ANGELES





It will pay you to investigate

"Bright LUSTRALITE® 10"
the revolutionary

BRONZE PLATING DISCOVERY that speeds
and improves electroplating at lower
production cost ...

"Bright LUSTRALITE 10" has proved its superior qualities in day-to-day use on products like these and many others. It definitely makes finishing less expensive by eliminating buffing and minimizing the need for nickel. Yet it has excellent resistance to corrosion. The plate has exceptional leveling power, with a true bright finish.

"Bright LUSTRALITE 10" produces a brilliant, fine-grained hard bronze that's practical for both decoration and corrosion protection. Available through the same distributors that handle other Battelle processes listed on the opposite side of this page.

SEE OTHER SIDE FOR DISTRIBUTORS

... For more information about Battelle-developed processes, get in touch with any of these authorized Battelle Development Corporation distributors. Each is fully equipped to give you complete data and technical help.

**THE ENEQUIST
CHEMICAL COMPANY**
100 Varick Avenue
Brooklyn 37, New York

P. B. GAST AND SONS
1515 Madison Avenue, S. E.
Grand Rapids 7, Michigan

**THE GLOBE CHEMICAL
COMPANY**
Murray Road at Big Four R. R.
Cincinnati 17, Ohio
—also Dayton and Louisville

HYDRITE CHEMICAL COMPANY
605-621 South 12th Street
Milwaukee 4, Wisconsin

KOCOUR COMPANY
4802 South St. Louis Avenue
Chicago 32, Illinois

LASALCO, INCORPORATED
2818 LaSalle Street
St. Louis 4, Missouri

G. S. ROBINS AND COMPANY
126 Chouteau Avenue
St. Louis 2, Missouri

SCOBELL CHEMICAL COMPANY
Rockwood Place
Rochester, New York

Be sure to read about "Bright LUSTRALITE 10"
on the opposite side of this page . . .

other Battelle Processes that simplify plating, add beauty and improve products

Electropolishing

A wide range of finishes is available. Gives products new sales values. Extraordinary smoothing action produces a micro-polished effect. "True metal color" is achieved with a lustre not attainable with belts or wheels. Metal surfaces remain undamaged.

Electrodeburning—A variation of electropolishing, excellent for smoothing sharp, burred metal for safe handling and precision functioning. Indispensable for parts having burrs in hard-to-reach places. For many items, electroburning plus electroplating produces the best possible and most economical finish.

Chemical Polishing

Smooths as it brightens. Won't etch. Brings out basic lustre. Especially suitable for small parts and those of intricate design. Can be plated over. Easy to install and operate . . . requires only a tank and heating element.

STANDARD[®] Bright Nickel

Produces mirror-like surfaces. Has excellent leveling action, ductility, and corrosion resistance. Very hard (Knoop 500-580) and wear resistant. On 18-gauge steel, can be bent around a 1/2-inch radius without cracking.

Tin Immersion

Coats copper and a variety of brasses and bronzes against "green water." Coats wires against corrosion. Easily controlled cold bath.

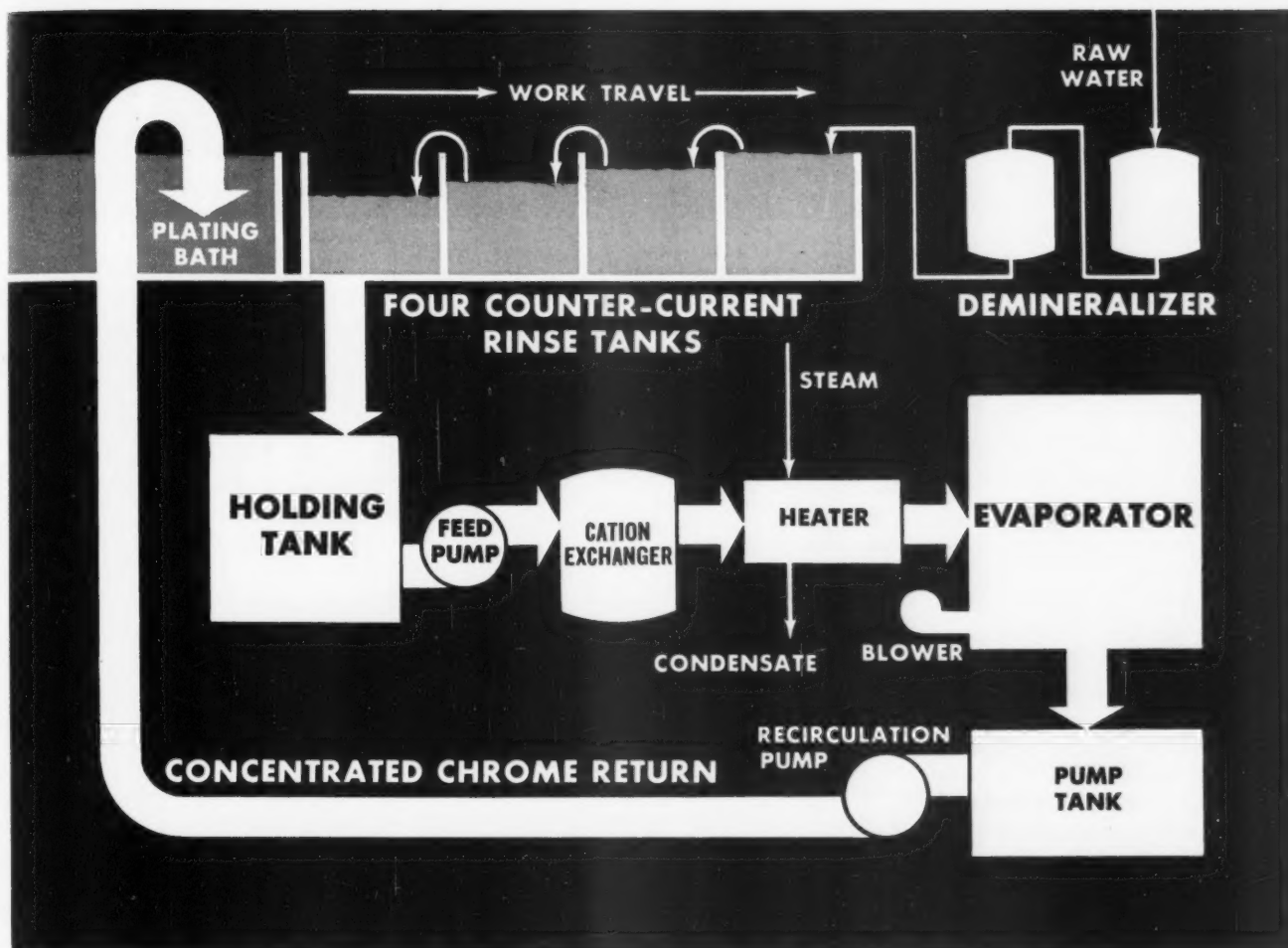
LUSTRALITE[®] Electroplating Processes also include LUSTRALITE 20, a rich golden plate; LUSTRALITE 10, a deep bronze red; and LUSTRALITE 45, silver white, of sterling appearance. Data upon request.

Please let me have more information. I am particularly interested in the following Battelle processes:

YOUR NAME _____
TITLE _____
FIRM NAME _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

want more data?

**mail coupon
to distributor
nearest you**



Chromium recovery costs less than destruction!

Designed for a large auto manufacturer, this Industrial Chromic Acid Recovery System was carefully analyzed for operating costs, including labor, power and amortization. When compared with a destruction system of equal capacity, **Industrial's system shows a net daily GAIN of \$26.65 against destruction COSTS OF \$54.06***

How Industrial engineered the system

After a thorough analysis of the entire plating operation, Industrial engineers recommended that the rinse water flow rate be reduced. When this was done, rinsing was still

efficient and complete with less than 4 ppm acid concentration in the final tank . . . but the higher concentration in the first tank made it possible to use a fast, convenient evaporator to recover chromic acid. No pre-concentration was needed (the small cation exchanger only removed metal contaminants). Industrial then planned and built the entire system including tanks and pumps.

We hope you noticed the key words . . . "thorough analysis" in the paragraph above. This is typical Industrial engineering—and at the auto plant it led to truly impressive gains in plating efficiency and economy. Why not use this kind of service yourself... **To solve your plating problems call Industrial . . .** and work with the men most experienced in the industry at handling plating solutions—all along the line.

*See article "Profitable Recovery of Plating Wastes by Reconciliation of Reduced Volume Rinses"—Odland & Hesler. *Plating*, August, 1956. Reprints are available of this paper by two Industrial engineers.

Send for complete data . . .

INDUSTRIAL

FILTER & PUMP MFG. COMPANY
5906 OGDEN AVENUE • CHICAGO 80, ILL.

Please send me literature and reprints of articles on plating waste disposal.

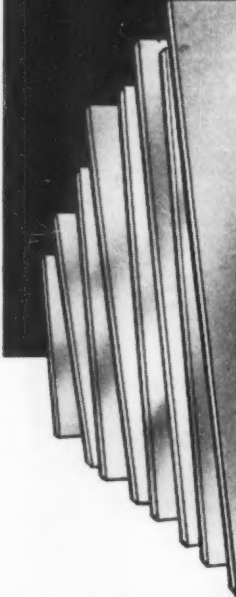
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COMPANY _____

ADDRESS _____

CITY _____ STATE _____

Look to Wyandotte for the



ALUMINUM

ETCHING

MIL-ETCH — Etches rapidly at low concentrations; gives uniform, fine-grained etch. No scale or sludge. Long life, simple control, no excessive foam or fumes, nondusty to handle.

CLEANING

ALTREX* — Nonetching, heavy-duty soak cleaner with long life, high detergency. Excellent for cleaning before anodizing, chemical film treatment, or preparation for spot welding.

SPRAY-ALTREX — Spray cleans without etching, has new low-foaming detergents. Easy to control, it works well in all kinds of water.

WYANDOTTE 468 — Neutral, solvent-type cleaner. Miscible with either hydrocarbon solvents or water. Removes oil, buffing compounds, drawing compounds without etching.

DESMUTTING

WYANDOTTE 2487 — Brightens aluminum alloys that darken in alkaline etching processes. Safer than acids; permits close control of desmutting bath. Easy-to-handle granular form; makes solutions of long life.

BRIGHTENING

I-2767-C — For brush or spray application; used as received or diluted with water. Brightens aircraft, truck trailers, aluminum equipment uniformly, rapidly without corroding surface.

PHOS-IT* — Liquid, phosphoric-acid-type product. Removes heavy corrosion quickly, brightens at the same time. Used diluted with water. For brush or dip application. Has high detergency, rapid action, low use-cost.

BARREL FINISHING

ALTREX — For deburring and radiusing with stones or chips. Offers excellent cutting qualities and economy.

BURNEK* 22 — For ball burnishing. Provides real economy for short and medium runs.

DEOXIDIZING

WYANDOTTE 2487 — Provides excellent preparation for spot welding. Gives uniformly low contact resistance on practically all alloys. No heat or close temperature control necessary. No appreciable surface etching. Work can be stored up to 96 hours before welding. Simple control.

best in products for

FINISHING

PAINT PREPARATION

PRE-FOS* — Cleans and prepares all alloys for paint. Adaptable to spray-washer or soak-tank use. Surface is uniformly conditioned to provide superior paint adhesion and corrosion resistance.

PHOS-IT — Excellent for wipe-on, wipe-off cleaning and paint preparation. Gives fine etch or "paint tooth," which results in an excellent paint bond.

Dependable Wyandotte products give you better results, shorten maintenance time, reduce operating costs. Send for free technical literature on the Wyandotte products designed to fit your aluminum-finishing operations. Or call in a Wyandotte representative, today. Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.

*REG. U.S. PAT. OFF.

PAINT STRIPPING

P-1075 — Fast-acting, nonflammable, room-temperature liquid paint stripper with a water seal. Removes most paint finishes without attacking aluminum. Economical — gives extra-long service life.

444-C — Removes paint from large parts or objects quickly. A thickened product for brush or flow-on stripping. Penetrates multiple coats of finishing materials with one application; is nonflammable, water rinsable.

SUPERSOLVE — Removes hard-to-handle enamels and other finishes quickly, without attacking metal. Used hot, diluted with water. Rinses easily.



Wyandotte
INC. U.S. PAT. OFF.
CHEMICALS

J. B. FORD DIVISION

THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

WYANDOTTE CHEMICALS CORPORATION

Dept. 3035 • Wyandotte, Michigan

Please send me more information on the following aluminum-finishing operations:

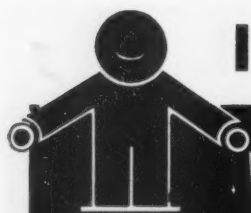
- | | |
|--|--|
| <input type="checkbox"/> Etching | <input type="checkbox"/> Barrel Finishing |
| <input checked="" type="checkbox"/> Cleaning | <input type="checkbox"/> Deoxidizing |
| <input type="checkbox"/> Desmutting | <input type="checkbox"/> Paint Preparation |
| <input type="checkbox"/> Brightening | <input type="checkbox"/> Paint Stripping |

Name _____ Title _____

Firm _____

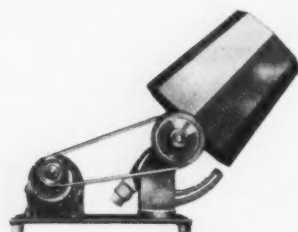
Address _____

City _____ Zone _____ State _____

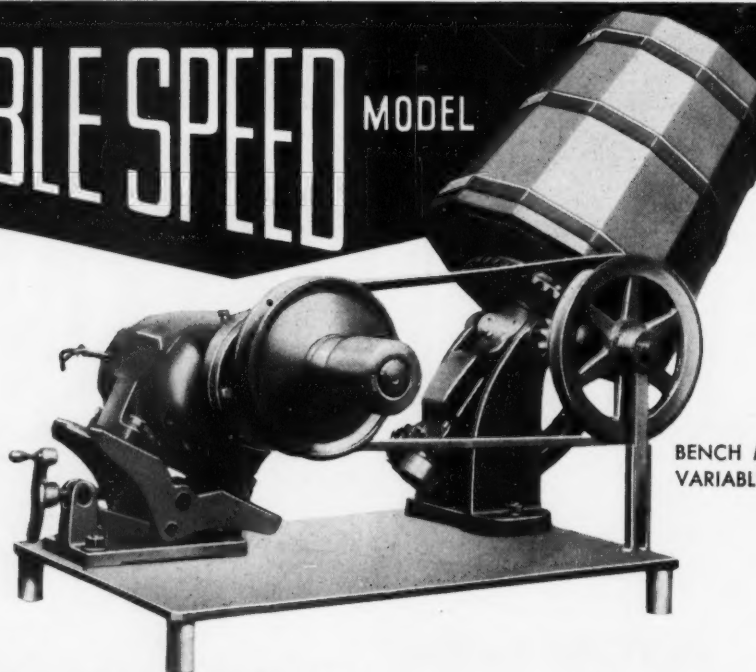


INVESTIGATE THIS TIME-SAVING

VARIABLE SPEED MODEL



Bench-Type Single Speed



BENCH MODEL
VARIABLE SPEED

Note Carefully These IMPORTANT POINTS

Barrels can be filled with parts or abrasive—*while running*.

Work can be watched — samples removed for inspection — *while running*.

Angle can be changed for best abrasive or polishing action — *while running*.

Barrels can be emptied by tilting to pouring position — *while running*.

Barrels are made in various sizes, shapes, and materials. They are easily replaced.



No. 5—Single Speed



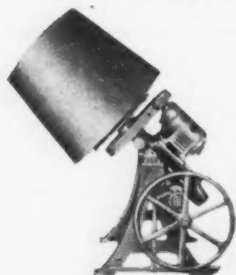
No. 5—Variable Speed



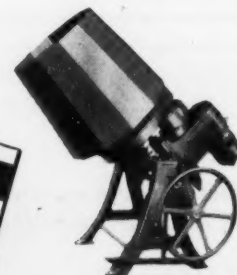
No. 5A—Single Speed



No. 5A—Variable Speed



No. 6—Single Speed



No. 6—Variable Speed

If You're a Tumbler, Send
for This NEW CATALOG

THE HENDERSON BROS. COMPANY

"The Tumbling Barrel People"

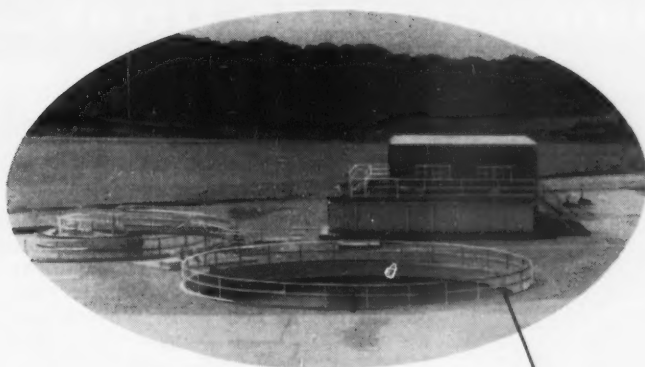
136 SOUTH LEONARD STREET
WATERBURY, CONNECTICUT



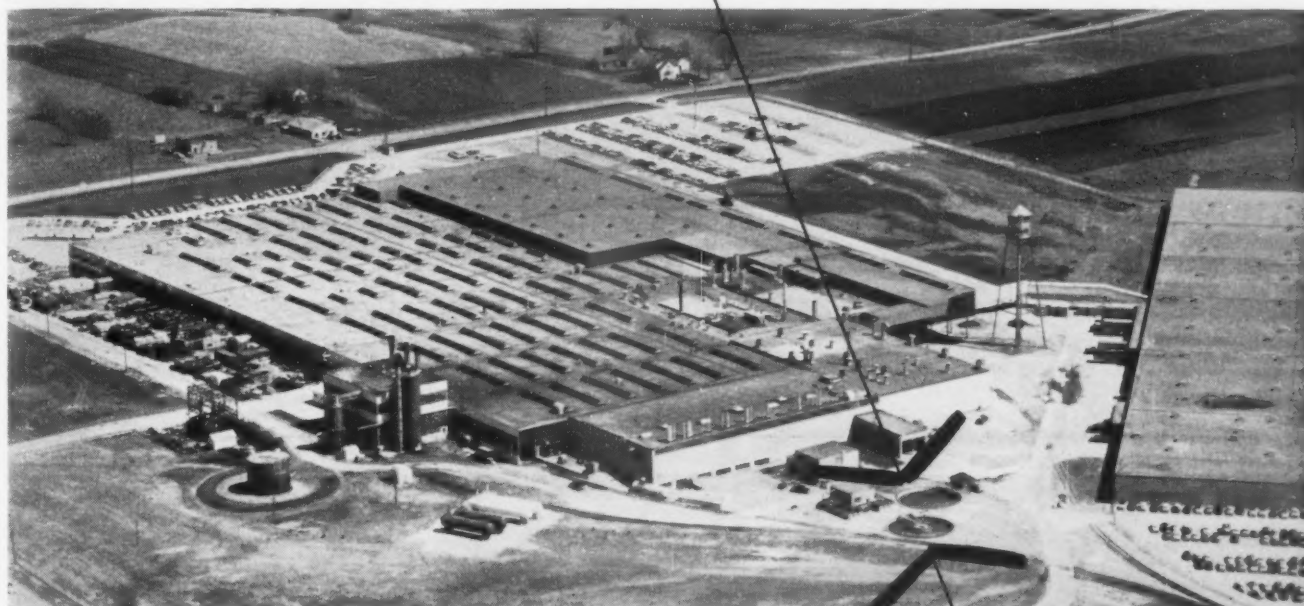
SINCE 1880

DESIGNERS AND BUILDERS OF TUMBLING BARREL EQUIPMENT





MAYTAG TREATS ITS WASTE AND CUTS ITS WATER BILL !



Black & Veatch, Consulting Engineers
Kansas City, Missouri

At its home office and factories at Newton, Iowa, The Maytag Company recovers approximately 70% of its metal finishing waste waters for re-use in plating and other plant operations.

1 MGD of segregated wastes from pickling, phosphating, porcelain enameling, electroplating, etc., are treated in VORTI® mixer basins and a CYCLATOR® clarifier to produce an effluent suitable for disposal or water reclamation.

Let your INFILCO representative discuss your specific waste treatment problems with your engineers. Send today for the following bulletins: 850 ("CYCLATOR" clarifiers); 700 (VORTI® mixers); 1960 (CATEXER® ANNEXER® ion exchangers).

State your chemical feeder needs. Or write for Bulletin 80 for the complete line of INFILCO equipment for every type of water and waste treatment problem.

INFILCO invites inquiries on all industrial water supply and waste-water treatment problems.



INFILCO
INCORPORATED

General Offices • Tucson, Arizona • P.O. Box 5033

Field offices throughout the United States
and in foreign countries

57444

THE ONLY COMPANY impartially offering equipment for ALL types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

Another fine product made finer...

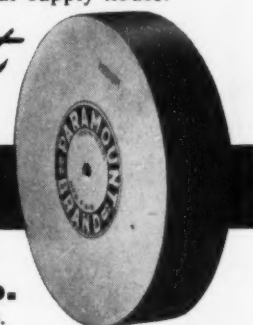


**with the PARAMOUNT
"Finishing Touch"**

"Fine finishes are essential to the sales success of our products," says L. E. Mason Co., leading manufacturer of quality gifts. "To highlight the copper plated and oxidized finish of the coasters, we depend on Paramount Felt Bobs. We get the precise color we want with no 'ragged highlighted ends' and without destroying contrast between the oxidized backgrounds and highlights. Your bobs give good cut, good life while producing the fine finishes we demand."

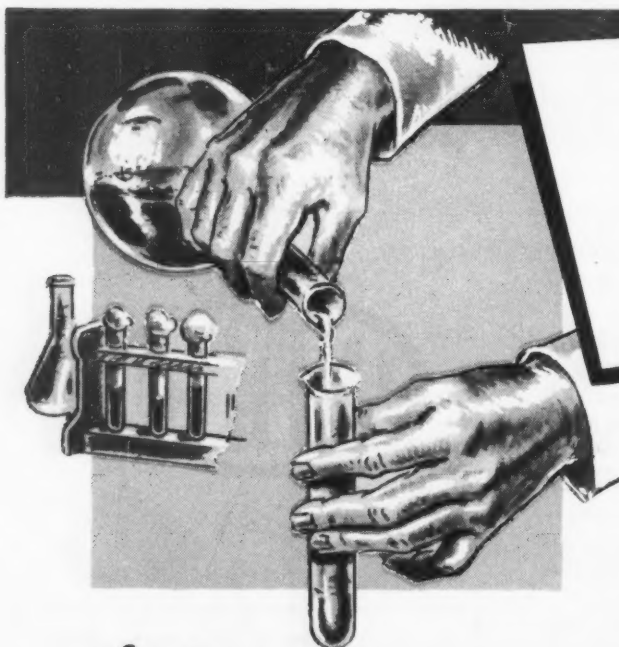
Wherever fine finishes count, successful firms use Paramount Wheels and Bobs. Join the leaders — specify Paramount. Call your supply house.

Paramount
Felt Wheels,
Bobs, Sheet Felt



Bacon Felt Co.
437 West Water St., Taunton, Mass.

44/Circle on Readers' Service Card



Rhodium
ELECTROPLATING SOLUTIONS

Technological knowledge acquired through many years of experience, plus special processes and equipment, assure the high quality of our Rhodium Plating Solutions.

Recommended for contact surfaces of switches, wave-guide parts and other electrical applications, such as printed circuits...Can be applied in extremely heavy deposits, up to 100 milligrams per square inch.

Rhodium plating provides the advantages of whiteness, lustre and corrosion resistance of a precious metal.

Consult our staff,
without obligation, about
your plating problems.

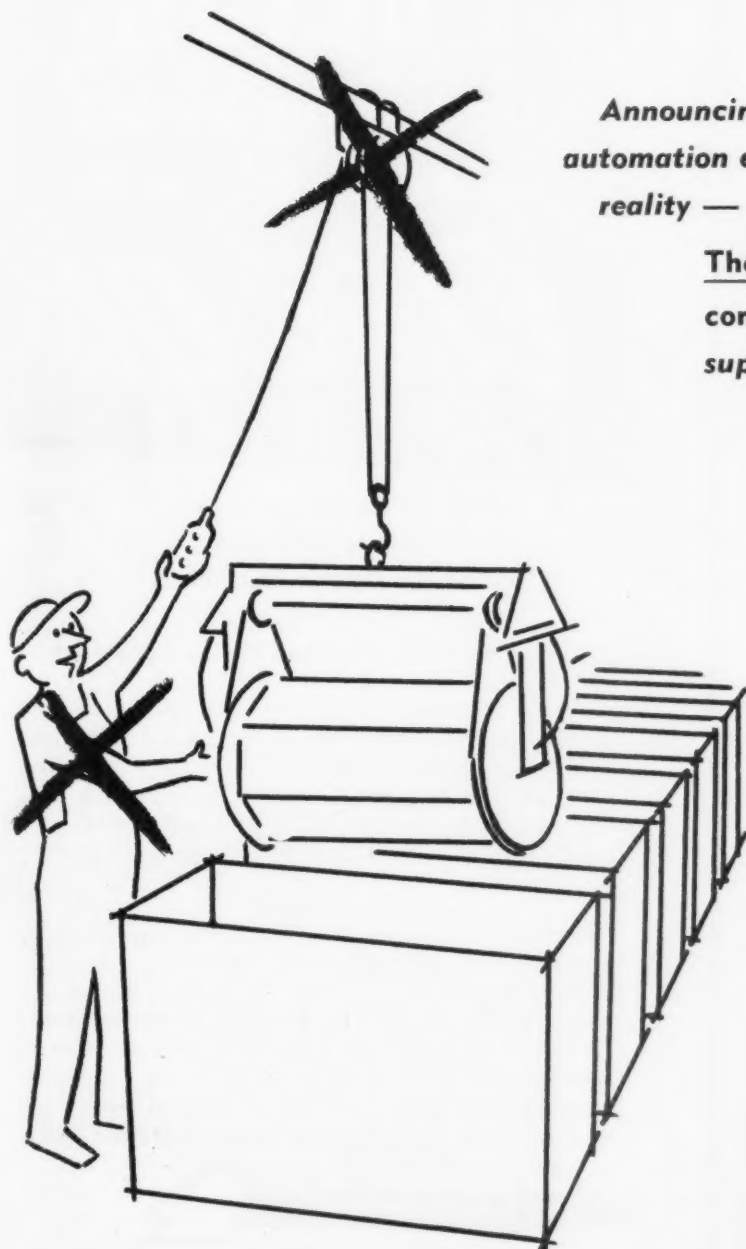


Specialists in the Unusual... SINCE 1901

SIGMUND COHN MFG. CO., INC.

121 SOUTH COLUMBUS AVENUE • MOUNT VERNON, NEW YORK

AUTOMATION comes to YOUR TANK LINES



Announcing: The most advanced development of automation engineering in metal finishing! Now a reality — perfected, patented, proven, practical.

The Abbey Process Automation System converts your present tank lines into a super-flexible automatic plating machine.

FULLY AUTOMATIC

Eliminates manual operations, human errors. Eliminates electric hoists, and their maintenance. Saves thousands in manhours, equipment, and headaches. Perfect automation for all typical job shop operations. For multiple variety plating runs in same line.

FLEXIBLE

Adapts to your *present tanks and superstructures*. Operates *all* your barrels through *all* cycles — cleaning, pickling, plating, rinsing, bright dipping, etc. — *any combination, all at the same time, automatically*. Has all the flexibility of your present tank and hoist lines, but is completely automatic — no hoists, no manual operations.

ACCURATE

One control center — set it and forget it. Perfect timing and sequence in all processes to your exact requirements. Vary at will — any barrel — any cycle — by remote control.

ECONOMICAL

Greatest profit-earner of its kind. Add tanks and barrels to your lines as desired. Faster, better plating at a fraction of former costs. No more losses due to manpower shortages, confusion, carelessness, etc.

Go Automatic for Less — The Abbey Way

Here's *true* automation! It adapts itself perfectly to your *individual requirements*. The first truly modern flexible automatic tank line system. Perfected after years of development, it promises to revolutionize barrel plating. Entirely eliminates the "human element" between barrel loading and unloading. Speeds processing, ends inefficiency, ends time and error losses. Pays for itself in extra profits. Not complete new

machinery. Not a radical plant re-design. Your present tanks and superstructures can stay on the job! Manual operations are *out*. More profits are *in*. Abbey Tank Line Automation is *here*. See it next issue — this space.

The G-S EQUIPMENT Co.

15585 Brookpark Rd. • Cleveland 11, Ohio • Clearwater 2-4774

**IT
CAN
BE
PROVED...**

TRERICE

**Self-Operating Temperature Regulators Improve
Plating Quality, Lower Your Plating Costs!**

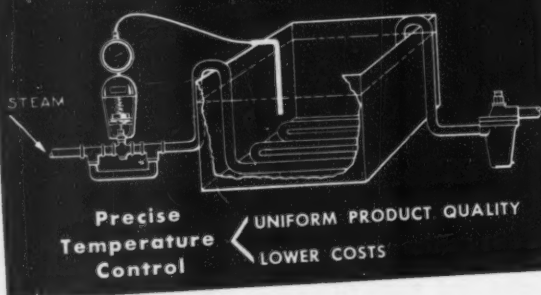
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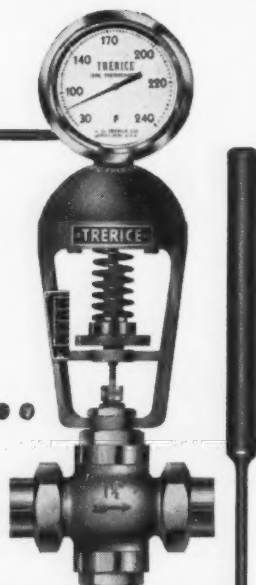
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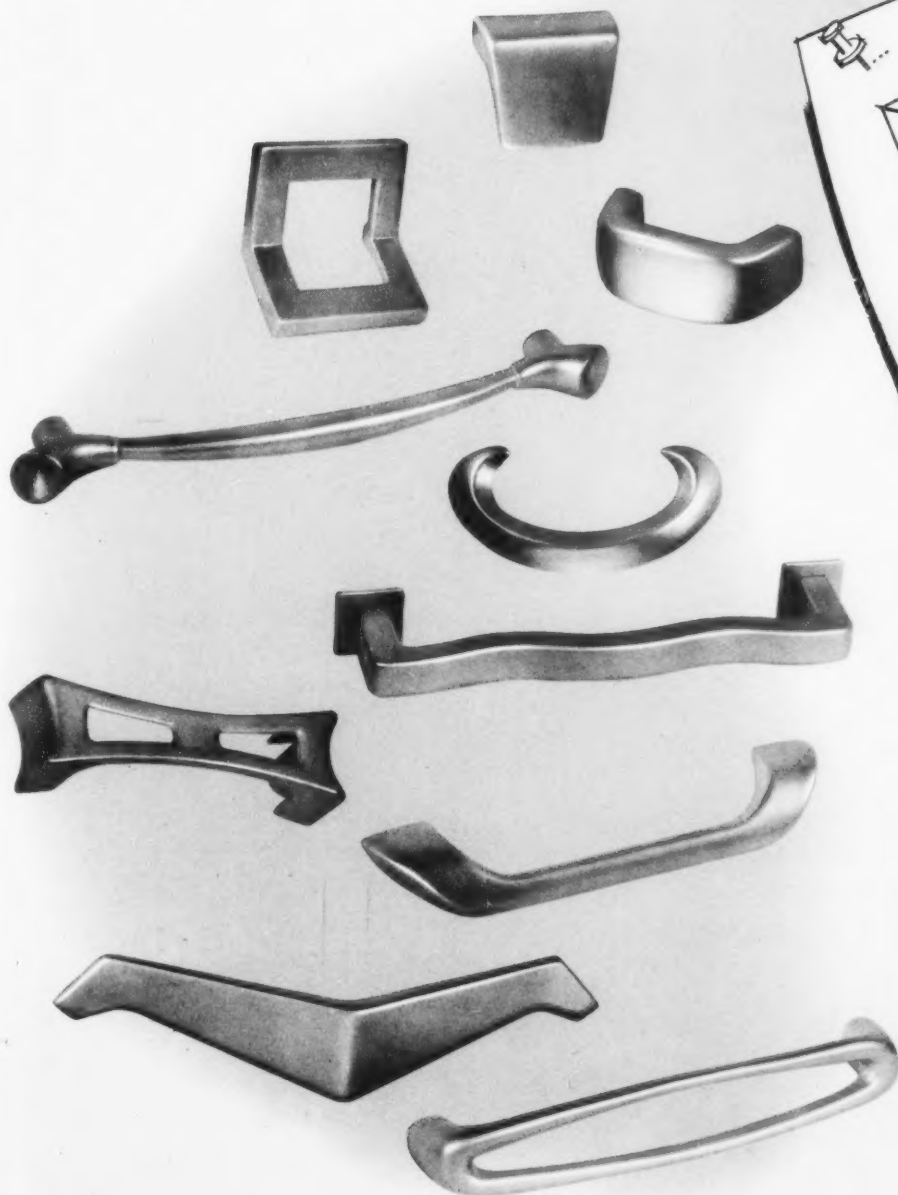
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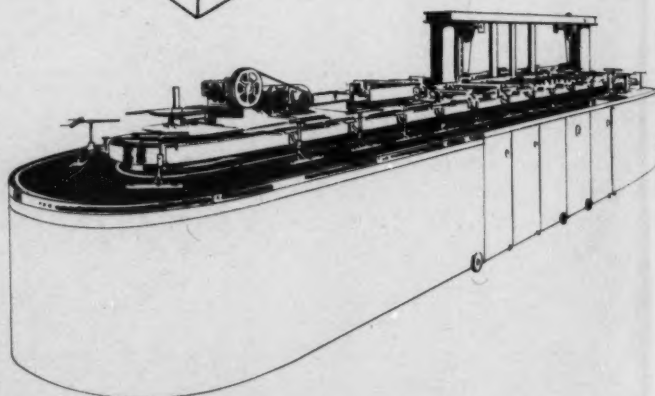
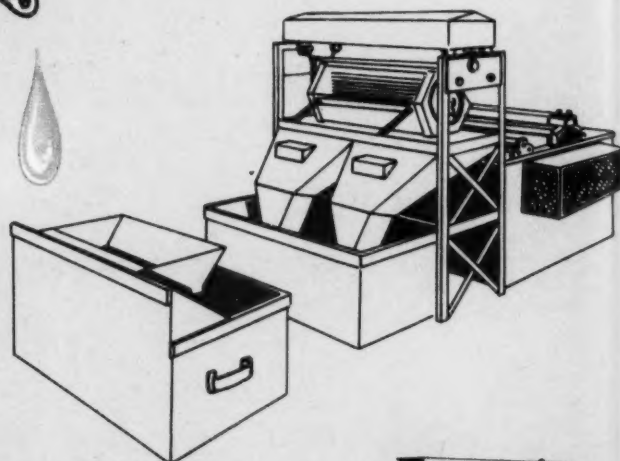
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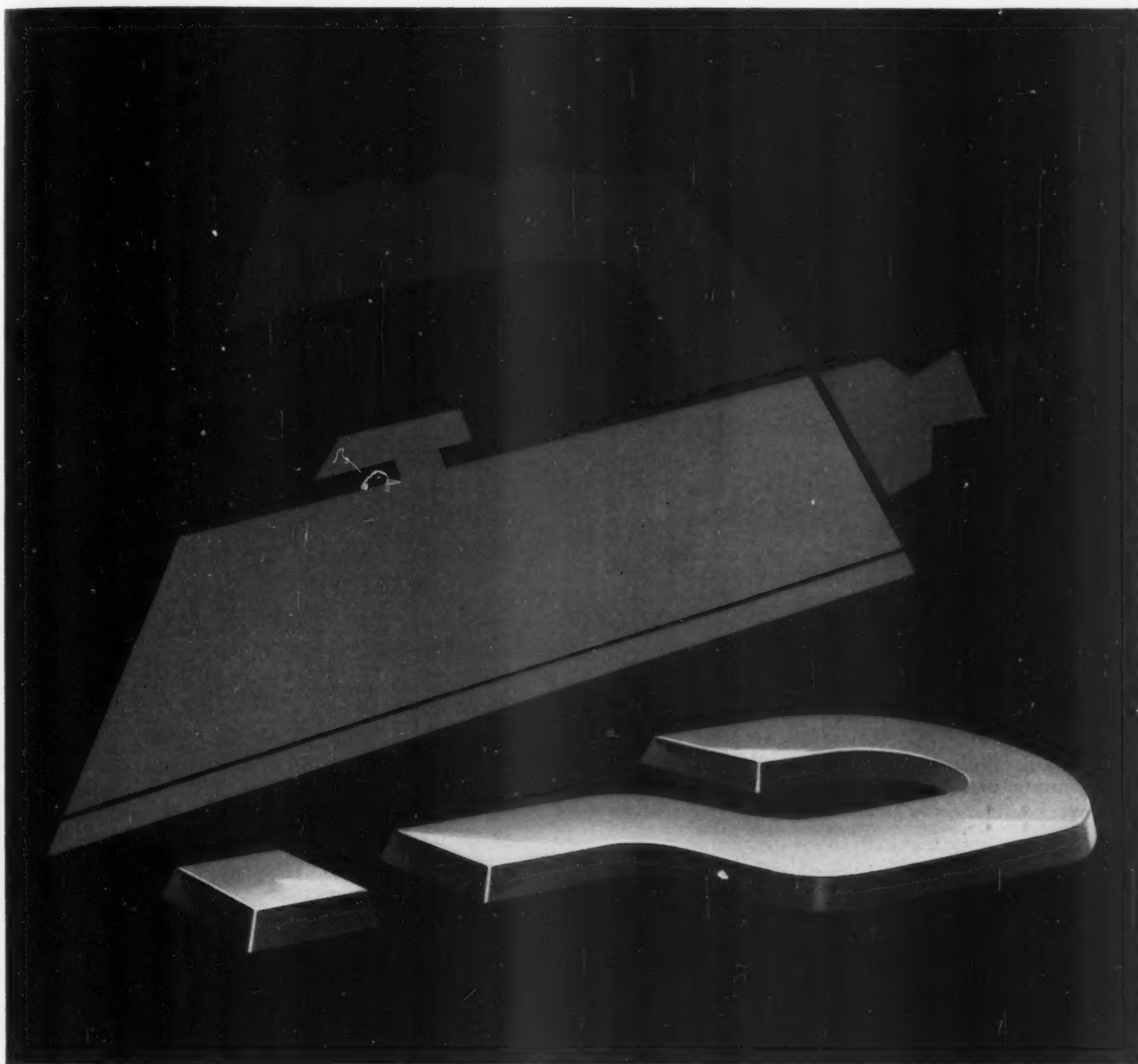
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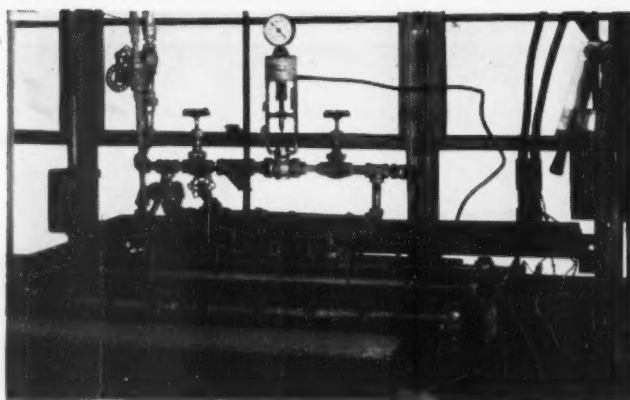
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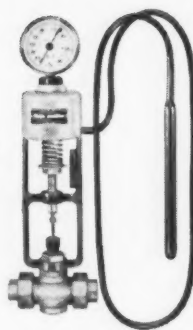
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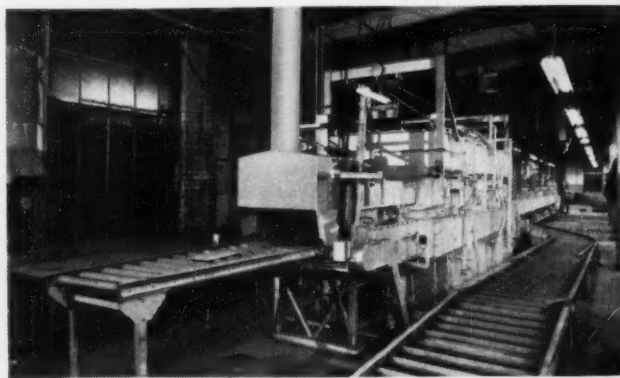


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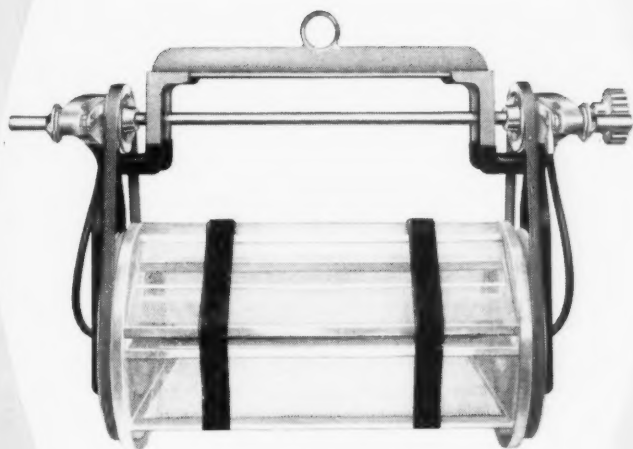
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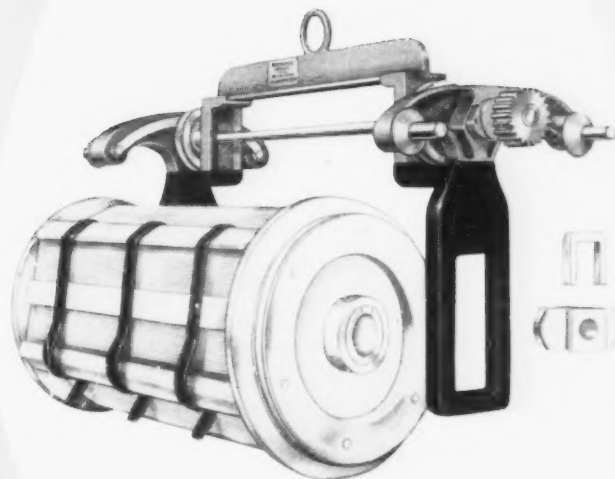
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MODEL A



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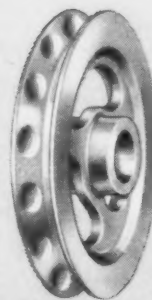
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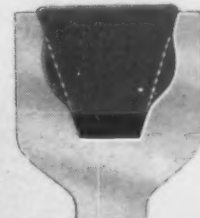
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OCTOBER, 1957

Volume 55 Number 10

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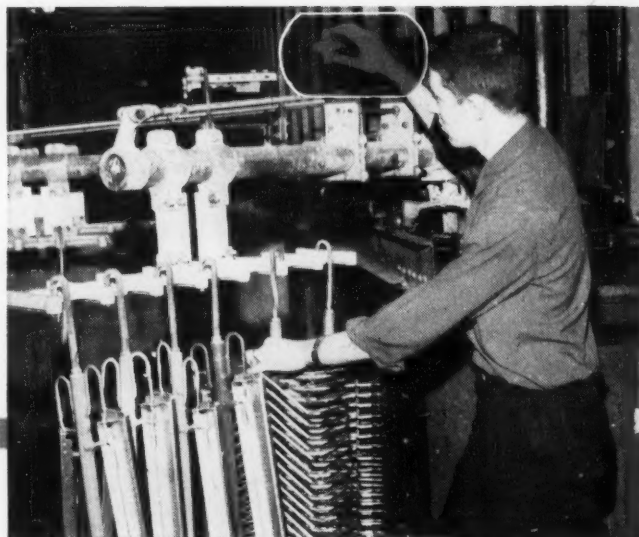
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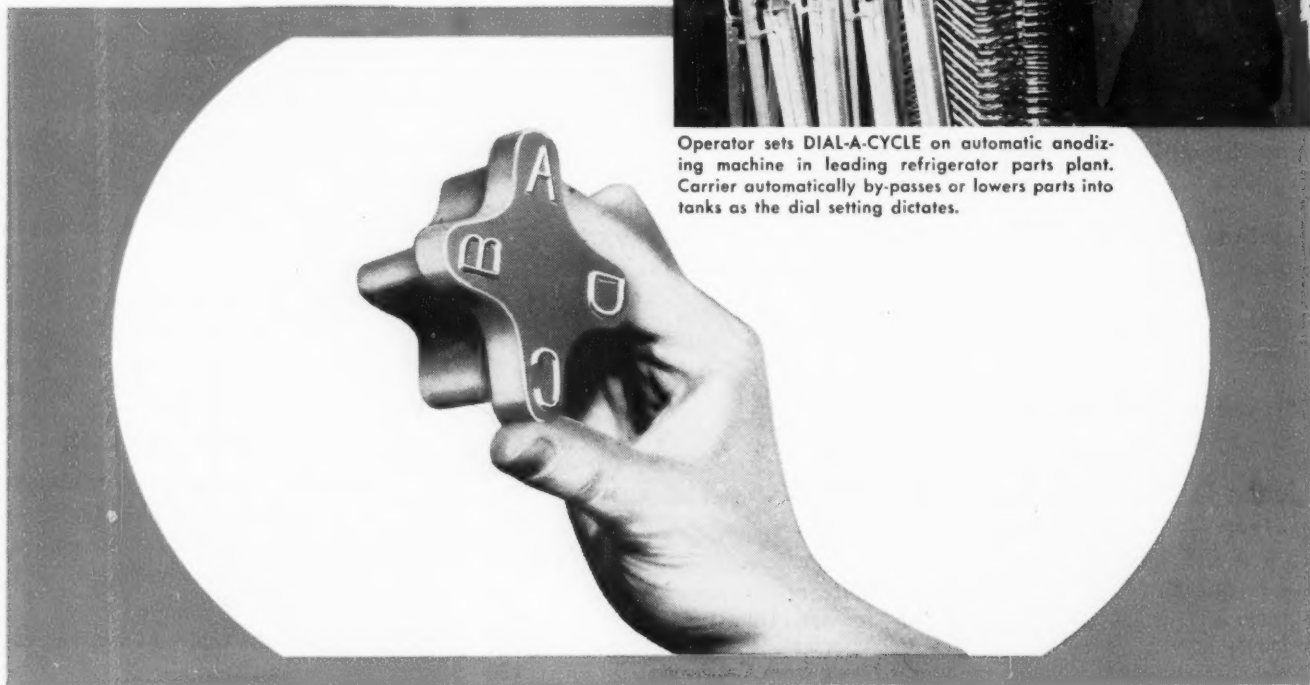


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We remember, about a dozen years ago when laws controlling wastes were first instituted, efforts were mainly concentrated on the wastes *after* discharge from the plating room, since it was assumed that a single treatment plant could process all wastes, regardless of composition. Experience with these early installations shortly indicated the advisability of segregation and, today, it is almost universal practice to treat cyanides, chromates, and acids and alkalis separately. Treatment of mixed plating wastes is possible only at the expense of efficiency; chemical and labor costs are high, and effective recovery of plating salts impossible.

If the composite waste is alkaline, the condition is suitable for cyanide destruction of chlorine, but the waste must then be acidified for rapid chromate reduction and realkalized again for discharge into the sewer. In addition, sufficient reducing agent is needed not only for the chromate but for the excess chlorine remaining from the cyanide oxidation. And, wetting agents and other organics from the cleaning line also consume chlorine, which unnecessarily increases consumption of this expensive reagent. Should the plating room effluent happen to be acidic, preliminary reduction of the chromate is still impracticable because subsequent oxidation of the cyanide will also reconvert some of the trivalent chromium to the toxic hexavalent form.

Segregation of the three major groups of wastes can be arranged without trouble when a new plating installation is being considered. Intelligent plant design insures that effluent from each operation is directed to the proper drain trough and waste receptor. The added expense of separate drains to chromate receptor, cyanide receptor, and acid-alkali receptor is very quickly recovered by resulting economies in treatment chemicals and salvage of reusable salts by ion-exchange or evaporation and concentration. Often the mixed acid-alkali waste is self neutralized and can be discharged directly to the sewer without further treatment, and with only an oil-grease skimmer or trap in the discharge line.

The real problem arises when a municipality institutes a control law affecting a plant already in operation. Here, close examination of the plating department layout may indicate a simple rearrangement of a few tanks and some piping, which will effectively segregate the different wastes. Since treatment will be necessary in any case, it will probably be cheaper in the long run to segregate the wastes and obtain the advantages, even if an involved expensive revamping is required. The rewards of efficient treatment are quite impressive in dollars and cents.

Nathaniel Hall

Corrosion Resistant Materials

— Metals and Alloys

By Lester F. Spencer, *Finishing Engineer, West Allis, Wis.*

OPERATIONAL procedures within a finishing plant involving cleaning, anodizing, electroplating, electropolishing or pickling require the use of containers that will hold a corrosive liquid or fused salt which will perform the intended operation. The tank material selection is further complicated in that the wide variety of processed metals and alloys will influence the solution concentration, the solution type, the temperature of operation, and, frequently, the application of a current that will speed up the operational procedures. In addition, a materials engineer must select a suitable rack, hanger, or basket material which will be immersed in the corrosive solution, along with a material recommendation for ductwork to carry off any undesirable fumes.

Although this discussion is primary on the use of metals and alloys as corrosion resistant materials, it is not to be inferred that the non-metallic materials, as exemplified by the plastics, rubber, glass, and ceramic containers, are not of equal importance. A few generalized statements can be made about these materials. Thus, the ever popular plastic materials, such as acrylic resins, vinyl resins and polyester resin bonded glass fiber tanks, are known to be resistant to a large variety of acid and alkali solutions at temperatures up to 150°F. for continuous operation. These materials are relatively light in weight; however, they frequently are susceptible to breakage and require careful handling. In addition, especially at the high operating temperature, the plastic materials require reinforcement in the form of angle bars at the corners to give them added strength.

Glass tanks and small ceramic crocks and jars are frequently used for plating applications; however, they require a protective outer shell since they are quite

fragile. In addition, they are subject to thermal shock, which requires the utmost care. The use of rubber is usually confined as a lining material for steel tanks; these materials are quite satisfactory for the handling of many of the inorganic acids with the exception of strong oxidizing acids such as nitric, chromic, and concentrated sulphuric acid. They are also affected by most solvents and oils and, with the exception of hard rubber, contact with mineral oils and greases will deteriorate the rubber. Maximum operating temperature usually given is at 150°F.

Lead and Lead Alloys

Lead, due to its chemical nature, is considered a corrodable material; however, this fact is stated to be the responsible factor for its corrosion resistance. This apparently contradictory statement can be adequately explained by the use of the well known "film formation" theory which is used to explain the corrosion resistance of other materials such as aluminum and the stainless steels. Thus, when lead is exposed to a corrosive medium, such as a pickling solution for the removal of scale, a compound of the lead and the corrosive agent will form a protective film and thus prevent further attack of the underlying metal. In determining whether this film formation will prevent the further corrosive action to proceed, the two conditions that must be satisfied would be (a) that the film is adherent, and, (b) that the film be either insoluble or even soluble within acceptable limits.

The ideal situation would be completely undisturbed protective film during the life expectancy of the equipment. In commercial practice, this condition is seldom achieved. Fortunately, this film is self healing. However, it should be realized that each time the self healing process is involved, a portion of the metal will cor-

TABLE 1
Specifications for Pig Lead (ASTM B29-55)

	Corroding Lead	Chemical Lead	Acid Copper Lead	Common Desilverized Lead
Silver, Maximum %	0.0015	0.020	0.002	0.002
Silver, Minimum %	—	0.002	—	—
Copper, Maximum %	0.0015	0.080	0.080	0.0025
Copper, Minimum %	—	0.040	0.040	—
Silver + Copper, Maximum %	0.0025	—	0.040	—
Arsenic + Antimony + Tin, Maximum %	0.002	0.002	0.002	0.005
Zinc, Maximum %	0.001	0.001	0.001	0.002
Iron, Maximum %	0.002	0.002	0.002	0.002
Bismuth, Maximum %	0.050	0.005	0.025	0.150
Lead (by Difference), Minimum %	99.94	99.90	99.90	99.85

rode. If the above fact is ignored and the conditions of operation are such as to permit abuse of a lead lining through chemical or mechanical means, premature failure of the lining will occur. These factors will be discussed.

GRADES OF LEAD:

Specifications for lead have been established by the American Society for Testing Materials (B29-55) which would include the following:—

1. "Corroding" lead, which is the purest grade available, has a marked resistance to corrosive environment that approaches both "chemical" and "chemical-tellurium" lead. However, due to the absence of metallic impurities within this grade, the bulk is used for the manufacture of white lead.
2. "Chemical" lead, which is used to a considerable extent in corrosion resistant linings, has a small percentage of silver (0.002 to 0.02%) and copper (0.04 to 0.08%) in the refined metal. It has been established that the presence of these residual elements increases the resistance to corrosion and improves both the creep and fatigue properties. "Acid Copper" lead conforms to chemical grade lead and is produced by adding the required silver and copper to common lead.
3. "Tellurium" lead, which can be considered as a variety of chemical lead, has approximately 0.04% tellurium added to a chemical lead analysis. The addition of tellurium retards the grain growth which is stated to be the contributing factor to its increased fatigue resistance.
4. "Antimonial" lead or, as it is frequently called, "Hard" lead, is ordinary lead with additions of 1.0 to 12.0% antimony. Antimony increases strength and hardness; the alloy types most frequently employed for chemical applications are those that have 4.0 to 6.0% antimony. Specifications limits of these materials are given in Table I.

Antimonial lead is considered harder and stronger than chemical lead, but this is only true to about the

boiling point of water. Thus², as the temperature increases, the strength of a 6.0% antimonial lead will drop until at about 248°F. it is equal to the strength of chemical grade lead and, above this temperature, the antimonial lead will actually become softer than chemical grade lead. It can readily be seen that this fact may present a serious problem when processing temperatures are raised without thought as to the effect of lining material within a tank. Thus, under these conditions where lower strength values of antimonial lead linings are encountered, it may be necessary to compensate for this strength drop by increasing the supporting structure. This is graphically illustrated in Fig. 1.

CORROSION RESISTANCE:

The corrosion resistance of lead alloys will be affected by:—(a) the type of corrosive medium; (b) the concentration of the corrosive medium; (c) those variables of velocity and temperature of the corrosive medium; (d) the degree of mechanical abuse, abrasion or erosion that may be present; and, (e) the pres-

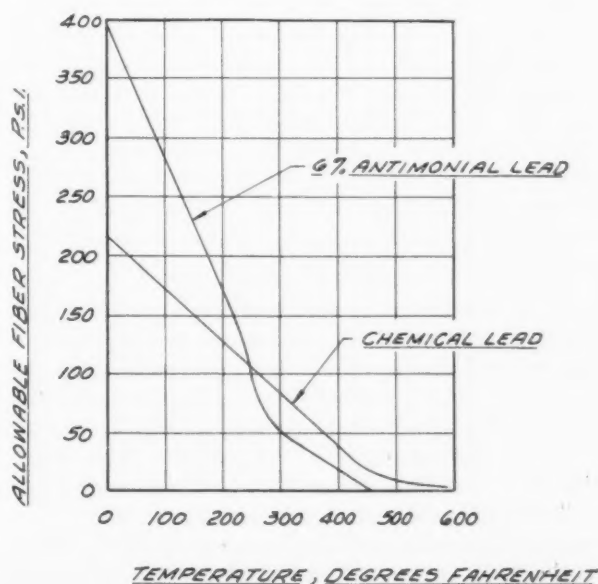


Fig. 1. Maximum allowable stress in 6% antimonial and chemical lead at various temperatures.

ence of stray currents, concentration cells, and dissimilar metals.

Lead should be used in those environments for which its use is recommended; the behavior of this material under varying conditions of acid type, concentration, and temperature have been investigated and published. Sources for this information can be obtained from Lead Industries Association.³ Generally speaking, lead has good resistance to neutral solutions where lead carbonate and possible lead oxide are the corrosion products.² It has fair resistance to alkaline solutions in which these are soluble. Thus, for certain purposes¹ corrosion of lead in contact with sodium hydroxide or potassium hydroxide up to 30% concentration at 75°F., and up to 10% concentration at temperatures to 190°F. is tolerable.

Experience has shown that lead is commercially resistant² to chromic, sulphuric, sulphurous, and phosphoric acids; that it is subject to corrosion at somewhat higher rates by hydrochloric and hydrofluoric acids; and, that it is susceptible to being strongly corroded by acetic, formic, and nitric acids. Nitrate salt solutions are moderately corrosive, whereas carbonate solutions are not. Lead is somewhat amphoteric; it reacts with alkalis to form plumbates as well as with acids to form lead salts.

Varied results are obtained where mixture of acids are encountered. Thus, mixtures of sulfuric and nitric acids can be used⁵ at room temperatures provided water present is less than 30%. Also, mixed hydrochloric and sulfuric acids have been handled successfully in lead² when the sulphuric acid concentration was above 15% and the hydrochloric acid below 5%. Although lead is recommended for sulfuric acid concentrations up to 96% at room temperature and up to 85% at temperatures as high as 385°F., Roll² has cited an example where lead would not perform satisfactorily in this acid type because a satisfactory protective film could not be developed.

The case involved was a lead-lined sulfuric acid vessel maintained partially filled; the corrosion proceeding at a much more rapid rate in the vapor zone. It was determined that the presence of oxygen produced a film that was less stable than a pure lead sulfate film and, therefore, failed to prevent corrosion. This situation was corrected by periodically raising the level of the liquid in the vessel long enough to obtain the more stable lead sulfate film. In general, it is a better practice to minimize vapor zone areas by maintaining vessels as completely full as possible.

In the event that a corrosive will not form this protective film and also will not dissolve such a protective film as lead sulfate, it is often possible to make the lining corrosion resistant by swabbing the lead with dilute sulfuric acid or, preferably, filling the storage vessel for a short period of time in order to establish this protective lead sulfate film. Roll² has stated that a 25 to 35% sulfuric acid will form this protective film on chemical lead at 70°F. in from 9 to 10 hours, whereas the 9.0% antimonial lead will form the sulfate film under identical conditions from 1 to 1½ hours.

Concentration cell attack, galvanic corrosion, stray

current corrosion, and stress corrosion are mechanisms which may influence the life of a lead lining. An example of concentration cell corrosion was the corrosion of a sheet lead duct⁷; the mechanism involving the deposition of sodium sulfate at specific areas by the condensation of a saturated vapor phase as it is conducted through the duct. The area beneath these deposits was severely pitted. However, by minimizing condensation and eliminating crystal formation within the ductwork the problem was overcome. Galvanic corrosion involving lead is seldom encountered, but, Roll² has cited special cases involving de-aeration of the corrosive medium. The reference can be consulted for details.

Lead is commonly used in electroplating operations as a tank lining material due to its resistance to most of the corrosive electrolytes. However, stray current corrosion can cause severe pitting of the lead lining if improperly installed. Reichard⁴ has stated that this condition can easily be corrected or prevented by observing the following precautions:—

1. Use double pole switches so that all tank bars are disconnected from all of the main bus bars when the tank is not in use.
2. Use adequate insulating units between electroplating tanks and their foundation.
3. Insulate heating coils and ventilators from their surroundings.
4. Maintain all insulators clean and dry to insure their maximum effectiveness.
5. Prevent bipolar action from developing in the installation.

Unfortunately, lead has approximately three times the thermal expansion exhibited by steel and, when it is subjected to a wide fluctuation of temperature, stress corrosion cracking may occur. This will expose new metal surfaces to corrosive attack which may ultimately lead to full penetration of the lining. Roll² has stated that the two approaches toward the elimination of stress corrosion cracking can be by:—(1) removing the source of stress by insulating the equipment from vibration; by spreading out the heating-cooling cycles; or, by lowering the peak temperature and, (2) counteracting the stress by specifying bonded lead lining or cladding; providing adequate strapping in a sheet lead lined vessel; specifying an acid brick and lead lining to minimize thermal shock; and, by using a thicker lead lining to reduce fiber stress. Tellurium-chemical lead has often proven advantageous over chemical grade lead for services under stress conditions.

Vibration may also be a contributing factor toward failure. Thus, Townsend⁶ tested commercially rolled sheet in a laboratory flexure machine; the following endurance limits were obtained for ten million cycles at a frequency of one-half million per day at a temperature of 78°F. The values were:—pure lead 440 psi; chemical lead 540 psi; tellurium-chemical lead 800 psi; and, antimonial lead 1040 psi.

Because of the relatively low strength of lead, it is usually supported by either wood, concrete, or steel. Certain woods, such as oak and douglas fir, have been

known to cause serious corrosion of lead due to the formation of organic acid type vapors. Seasoned cedar and hemlock are the preferred woods. In constructing lead-lined wood tanks, the wood should also be free of insect larvae since there are instances of failure caused by insects boring through the lead lining. Where green concrete is used, calcium hydroxide, which is formed in the hydration of portland cement, will cause severe corrosion of lead provided that moisture is present. The concrete should be cured, converting the calcium hydroxide to a calcium carbonate which will not affect lead. Another preventative method is to apply an asphalt or similar coating to the concrete prior to the installation of the lead lining; this providing the necessary protection until the concrete is fully cured.

Bonding lead to the supporting steel shell will increase the strength-carrying properties of the lead lining. For ordinary operating temperatures, tin or a lead-tin solder can be used for bonding. However, for high temperature operation, "homogeneous" lead linings are employed, which can hold their strength at temperatures nearly as high as the melting point of lead. Pipe, and both heating and cooling coils made of lead require support. In the event that high strength is re-

quired, lead lined steel pipe may be used and, in the case of coils, copper tubing completely covered with lead can be employed. In the latter case, lead covered copper coils can be used with steam pressures exceeding 50 and up to 150 pounds of steam pressure. Due to the fact that both the chemical composition and metallurgical condition of lead is unaltered after service in handling corrosives, lead has a high salvage value.

The Stainless Steels

The term "stainless" has become acceptable terminology to the family of steels under discussion since it has proven that this series of alloys does have desirable corrosion resistant properties. However, it should be realized that there are limitations in their use for applications involving corrosion; this fact indicating that a thorough study be made before a recommendation is made for any specific application.

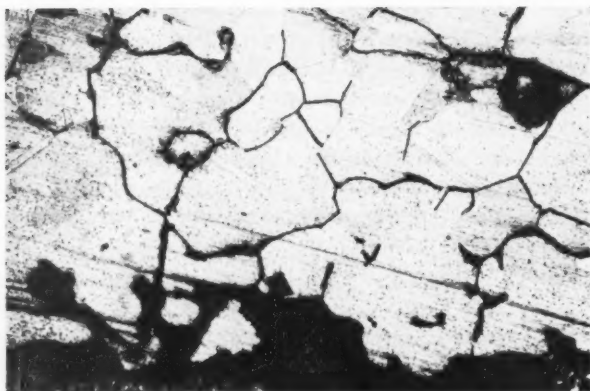
The corrosion resistance of the stainless steels is attributed to the development of a protective film on the metal surface. The presence of chromium is chiefly responsible for the formation of this oxide film; this factor being in proportion to the chromium content

TABLE 2
Chemical Composition of Stainless Alloy Types*10

Type	Carbon, Maximum	Chromium	Nickel	Molybdenum	Others
Wrought Alloys					
Austenitic Alloys					
302	0.08/0.20	17.0/19.0	8.0/10.0	—	—
304	0.08	18.0/20.0	8.0/12.0	—	—
304L	0.03	18.0/20.0	8.0/12.0	—	—
309	0.20	22.0/24.0	12.0/15.0	—	—
309S	0.08	22.0/24.0	12.0/15.0	—	—
310	0.25	24.0/26.0	19.0/22.0	—	—
316	0.08	16.0/18.0	10.0/14.0	2.0/3.0	—
316L	0.03	16.0/18.0	10.0/14.0	2.0/3.0	—
317	0.08	18.0/20.0	11.0/15.0	3.0/4.0	—
321	0.08	17.0/19.0	9.0/12.0	—	Ti-5 x C min.
347	0.08	17.0/19.0	9.0/13.0	—	Cb-Ta, 10 x C min.
20 (not std.)	0.07	20.0	29.0	2.0	3.0 Cu
329 (not std.)	0.10	23.0/28.0	3.0/5.0	1.0/2.0	—
Chromium Alloys					
430	0.12	14.0/18.0	—	—	—
410	0.50 Max.	11.5/13.5	—	—	—
Cast Alloy**					
CB-30	0.30	18.0/22.0	2.0 Max.	—	—
CC-50	0.50	26.0/30.0	4.0 Max.	—	—
CF-8	0.08	18.0/21.0	8.0/11.0	—	—
CF-8M	0.08	18.0/21.0	9.0/12.0	2.0/3.0	—
CF-8C	0.08	18.0/21.0	9.0/12.0	—	Cb, 8 x C min., or Cb-Ta, 10 x C min.
CK-20	0.20	23.0/27.0	19.0/22.0	—	—
CN-7M	0.07	18.0/22.0	21.0/31.0	—	Mo-Cu
CH-20	0.20	22.0/26.0	12.0/15.0	—	—
CH-10	0.10	22.0/26.0	12.0/15.0	—	—

* Most Commonly Used Materials.

** Cast alloys are normally characterized by higher silicon and chromium contents than the corresponding wrought grades.



An example of intergranular attack exhibited by the stainless steel, type 302. Corrosive attack has extended along the grain boundaries. Individual grains are in evidence.

within the alloy regardless of the amount of nickel that may be present. The 12% chromium composition, which is listed as type 410 in Table II, is considered as the minimum to permit the spontaneous formation of this film under normal atmospheric conditions; the 17% chromium composition, listed as type 430, is more corrosion resistant since this spontaneous action in forming the oxide film occurs with greater ease; whereas, the 28% chromium alloy is the most corrosion resistant within the straight chromium type analyses.

In the event that nickel is added to a high chromium composition, to form the well known austenitic steels, the protective film forms more easily and quickly, and the stability is appreciably greater. Due to their change to a completely austenitic microstructure, these alloys will also have greater ductility, toughness, and strength at elevated temperatures when compared to the straight chromium steels. Here also, increased corrosion resistance is obtained as the total alloy content increases. Thus, using type 302 as the base, type 316 with the addition of 2.0% molybdenum has, in general, greater resistance to the same type of corrodent, and both 25-12 (type 309) and 25-20 (type 310) have even a higher resistance to corrosion. The columbium bearing stainless, type 347, is approximately equal in corrosion resistance to type 302.

In order to obtain maximum efficiency of a chosen stainless composition when exposed to a corroding environment, there are certain precautions that should be observed. One of the more common causes which accelerate corrosion is that of intergranular corrosion in the austenitic stainless steels. Thus, taking type 302 as an example, the welding of a rack, basket, or even a tank, may cause an intergranular carbide to form. Upon exposure to a corroding medium, the areas that contain these intergranular carbides will corrode rather rapidly. This is often termed "weld decay". A simple heat treatment to about 1950°F. followed by a cooling sufficiently rapid to avoid the re-precipitation of these

dissolved carbides will be sufficient to avoid this localized corrosion. Other expedients would be the selection of a very low carbon type, such as type 304, which will limit the formation of the undesirable intergranular carbide to a minimum, or the use of a stabilized stainless, type 347; the use of these two alternates will frequently eliminate the heat treatment.

Frequently, an electric current may be passed through stainless equipment in such a manner as to make it anodic as a whole or in part; this practice being used in electropolishing or pickling where direct current is imposed for electrolytic purposes. However, incidental, accidental, or stray electric currents may produce undesirable pitting attack on the stainless equipment⁸. If proper grounding precautions are not observed, stray currents from leakage or induction will set up an electrolytic action which attacks the stainless. Shunting or grounding any of these currents will halt the resultant corrosion; if this cannot be done, a small counter-current is frequently used to neutralize the effect of a stray current.

Another type of premature corrosion of the stainless steels by a pitting action is "contact corrosion". Thus, whenever any solid or semi-solid material adheres to or lies against a metal surface or within a lapped joint in contact with an electrolyte, the protective film in this area may be destroyed. The damage to the film cannot easily be repaired due to the inaccessibility of an oxidizing agent that is so essential to the restoration of this protective film. The rate of attack will depend upon the electrolyte and the specific stainless composition involved. This type of attack may be prevented by the use of (a) a more corrosion resistant alloy; (b) by careful design to eliminate focal points where this type of corrosion may occur; and, (c) by regular and efficient cleaning.

Erosion may also cause difficulty; this type of corrosion being experienced in nozzles, fan blade tips, pipes, and restricted passages when under the influence of a corroding environment moving at high speed. In many instances, the stainless steel would be unaffected if the corrodent were motionless. Evidently, the velocity of the corrodant destroys the protective film which has no time to be repaired. However, to what degree erosion alone causes the wearing away is still in doubt. Recommendations given to minimize this effect⁸ would include alteration of the contours at points eroded, decreasing the impingement, reduction of the turbulence, and increase in the overall flow efficiency of the liquid. If the solution is of an oxidizing nature, the action of the fluid at high velocities may actually aid in keeping the stainless steel free from sludge or deposits that may cause a pitting attack, the oxidizing nature of the corrodant serving to preserve the protective film.

(To be continued next month)



Vapor Stripping of Stop-off Coatings

By Edward R. Jorczyk, B.A., M.A., *Lycoming Division, Avco Mfg. Corp., Stratford, Conn.*

Introduction

ONE disagreeable task that exists in a plating department is the removal of organic stop-off coatings from selectively plated parts. The painting department also faces a similar task with defective paint films. The removal of these coatings is usually accomplished by immersing the parts in organic solvents or else in aqueous solutions formulated with caustic soda. One particular disadvantage of thinners, which are formulated for stripping, is that they are usually flammable and require fire precaution measures, such as automatic fire extinguishing equipment. Organic strippers formulated with cresylic acid are somewhat toxic and adequate ventilation is required as well as protective clothing for the operator. Aqueous solutions formulated with caustic soda are usually operated at an elevated temperature and can cause serious burns. They are usually satisfactory for use with steel but will etch aluminum, which may be undesirable.

One particular organic solvent, which does not possess most of the undesirable characteristics of the other types of paint strippers, is methylene chloride. It is non-flammable, non-corrosive, chemically stable, fast acting, without objectionable odor, and has a low vapor toxicity. Methylene chloride has been used for years in paint stripping formulations with excellent results and, only recently, has been used with success in vapor degreasers for degreasing metals and also for stripping paints. The author's company has been using methylene chloride for lacquer stripping during the past year in a converted trichlorethylene vapor degreaser with good results as well as with appreciable savings in cost and material, together with the elimination of a fire hazard.

Experimental Procedures and Results

Special Process Engineering conducted the investigation to determine whether methylene chloride, used in a vapor degreaser, could be substituted for the stripping thinner that was being used at that time.

For test results, ten aluminum panels (1 x 4 x 1 $\frac{1}{16}$ inch) and ten steel panels of the same size were masked with tape on one side. The ten aluminum panels were dipped into the stop-off lacquer once in order to simulate the insulation put on aluminum pistons. The ten steel panels were dipped three times with a 1 $\frac{1}{2}$ hour air dry between coats. All panels were

then baked in an oven for one hour at 150°F. The aluminum panels were then placed in an electroless nickel plating solution at 190°F. for three hours to allow further setting-up of the lacquer. The steel panels were silver plated to a thickness of 0.005". The panels were subjected to the same conditions that actual parts would be in order to simulate the two as closely as possible.

To simulate conditions that would occur in a degreaser a tall glass cylinder, approximately 18" high and 6" in diameter, was obtained. A condensing coil was made from copper tubing and placed at the top of the cylinder and cold water was circulated through the coil. Methylene chloride was placed in the cylinder to a depth of six inches. The cylinder was placed on a steam table so that heating could be gradual and easily maintained at the lower temperature. The unit worked very well and could also be used to degrease laboratory specimens. The lacquered panels were then subjected to methylene chloride,



Typical Stripping Operation.

either at room temperature (75°F.) or at its boiling point (104.2°F.) and the time required to strip the lacquer from the panels was noted. The time required to strip one coat of lacquer in methylene chloride at room temperature was 2 minutes, while three coats required 7 minutes. Increasing the temperature of methylene chloride to its boiling point cut the stripping time in half.

One particular drawback found with panels stripped in the vapor area was that the panels would reach the vapor temperature before all the lacquer was removed. Condensation of the vapor on the panel ceases when it is at the same temperature as the vapor; therefore, no further stripping would occur. Thicker sections of actual parts were tried in place of panels and these were stripped of lacquer satisfactorily.

Methylene chloride had no adverse effect on nickel plated aluminum panels or silver plated steel panels. No discoloration or etching was evident on any of these metals when they were subjected to methylene chloride at room temperature for 24 hours or at its boiling point for 6 hours. Both the liquid and vapor phase corrosion, in mg./in²/day, is substantially lower in methylene chloride than it is in either trichlorethylene or perchlorethylene.

Preliminary tests showed that this type of application had merits and an actual shop trial was recommended. A trichlorethylene vapor degreaser was converted for use with methylene chloride. An adjustable temperature regulator was installed to control the steam to the heating coil. A lower temperature safety bulb was placed above the cooling coils, so that, if the vapors rose above the cooling coils, the steam supply to the heating coils would automatically be cut off. The side tank into which the condensate from the cooling coils flowed was raised in order to eliminate the backing up of contaminated solvent in the boiling chamber into the side tank, which occurred when the depth of the solvent in the boiling chamber was increased to twelve inches.

The unit was placed into operation and lacquer was stripped from piston domes in 15 minutes by placing them in the vapor area. Silver plated steel parts, which had heavy coatings of lacquer, were placed in the boiling solvent for 15 minutes and then flushed clean, using a spray lance connected to the condensate tank. As the solvent became contaminated with lacquer, it became more difficult to keep the vapor level up. Cleaning out the degreaser disclosed that the lacquer had baked onto the steam coils and insulated them to a thickness of $\frac{1}{8}$ inch. A wetting agent was added directly to the methylene chloride in the boiling chamber and this condition was virtually eliminated. The degreaser is cleaned every four to six weeks depending upon how contaminated the methylene chloride is with lacquer.

Discussion

Prior to the use of methylene chloride in a vapor degreaser, the company used a stripping thinner for removing this lacquer. The thinner was contained in three tanks. The lacquered parts were placed in the first tank and were allowed to soak. Periodic brushing was required to loosen the lacquer film. When most

of the lacquer was removed in the first tank, the parts were moved to the second tank where the rest of the lacquer was removed. A final rinse in the third tank, which contained reasonably clean thinner, was required to remove all traces of lacquer. Approximately 600 gallons of stripping thinner were used each month for this operation, at a cost of \$1,200. Using the vapor degreaser, only 200 gallons of methylene chloride were used for the same operation at a cost of about \$270. Savings per month, realized by Lycoming, are about \$930, together with improved working conditions, as well as the elimination of a flammable liquid which constituted a fire hazard.

One disadvantage of methylene chloride is its low boiling point, and rapid volatility. It boils at approximately 104.2°F. Since the material is not flammable, storage is not a great problem. The only requirements are, that it be stored in a cool place away from any sources of heat, so that internal pressures within the drum do not build up. Degreasers containing methylene chloride should also be placed away from external sources of heat, as well as in a draft-free area. The top of the degreaser may be baffled to prevent loss of vapors if there are drafts.

Further savings may be realized in large installations where the usage of methylene chloride would warrant the reclaiming of the material by distillation. Recovery of methylene chloride is similar to that of trichlorethylene, except that each should have an individual still.

Custom-made units can be designed in such a manner that the steam coils do not come in direct contact with the methylene chloride contaminated with lacquer. This would eliminate the necessity of adding a wetting agent. However, with some paints or lacquers, the addition of a wetting agent or amine may be desirable. An important item is the spray lance. This is required to flush off any traces of lacquer remaining on the parts after they have been stripped in the boiling solvent. The spray lance is connected to the side tank into which the condensate from the condensing coils flows. The methylene chloride coming from the spray lance must be clean; otherwise, traces of lacquer will remain on the part. Covers should be placed on the degreaser when it is not in operation in order to minimize loss of solvent by evaporation.

Methylene chloride can be used to strip many types of organic coatings such as lacquers, paints, enamels, and varnishes. One can easily determine whether vapors or boiling methylene chloride can be used to strip his particular material by constructing a model degreaser described elsewhere in this paper and actually running sample parts or representative samples.

Conclusion

Methylene chloride can be used successfully in a degreaser designed to contain this solvent. Various types of organic films can be stripped in either the vapor or liquid area of the degreaser. The degreaser can also be used to remove cutting and slush oils from metal parts. Appreciable savings may be realized from this type of application over present methods, and this can easily be demonstrated in the laboratory.

Maintenance of Electrical Equipment in the Plating Room

By Joseph F. Day, *Electrical Engineer, The Udylite Corp., Detroit, Mich.*

Motor Generator Maintenance

CLEANING:

Every two weeks, both the motor and the generator should be thoroughly blown out with dry compressed air, to remove any dust or foreign material. The external surfaces of the units should be wiped off with a soft cloth and the bearing housings checked for oil or grease leakages.

COMMUTATOR:

After the machine has been in operation for a few months, the brush contact faces and the commutator face acquire a hard smooth surface as the areas of contact become uniformly distributed. Until the machine develops this fine finish, there may be slight variations of contact between the brushes and commutator at different bands of the brush track. This banding may give the appearance of threading of the commutator and brushes, and may grow to the extent that it gives the appearance of excessive wear but, with proper maintenance, it will soon settle down to a permanent condition.

The undercutting between the bars of the commutator should be cleaned regularly at least every three months to remove any copper or carbon dust, or other foreign matter. A thin, flat piece of wood or fibre is recommended for this purpose. The mica should always be kept approximately 0.025 to 0.035 inch below the surface of the commutator bars. When it becomes necessary to remove surplus mica, a knife, or broken hack saw blade on which the "set" of the teeth has been ground off, is effective in cutting the mica down to the required depth. Be sure that the slots are left clean and that no small flakes of mica project to the surface of the commutator on the sides of the bars. All sharp corners along the edges of the commutator bars should be rounded to prevent a cutting or scraping action on the brushes.

BRUSHES:

Examine the brushes frequently to be sure that they are free to move in the brushholders. If necessary, remove the brushes from the holders and clean them thoroughly to remove any accumulation, using carbon tetrachloride if there is any oil or other sticky matter present.

Before starting the motor-generator, after sanding in new brushes, be sure to blow and wipe all sand and carbon dust from the windings, brushes, brushholders, and commutator.

Do not substitute a different grade of brush for that furnished with the generator. The brush tension should be between two and three pounds per square inch of brush contact measured with the spring balance hooked or fastened to the end of the brush tension finger.

COUPLING:

Coupling bolts should be checked every six months, tightened if they become loose. A spare set of coupling discs or links should be carried in stock for each flexible type coupling.

BALL BEARINGS:

Quietness and life of ball bearings depend largely upon care in installing, cleanliness, and proper lubrication. Ball bearings are especially sensitive even to a small amount of dirt or grit. They must be protected at all times. Grease should always be kept in a tightly sealed can to keep out dust and grit.

When shipped from the factory, the bearings have sufficient grease, and one complete turn of the grease cup every three to four months will usually be sufficient. If experience indicates that this is too much, the quantity can be decreased. The ideal condition is when the bearing housing is from $\frac{1}{3}$ to $\frac{1}{2}$ full.

SLEEVE BEARINGS:

In the case of sleeve bearings, always stop the motor-generator set before adding oil.

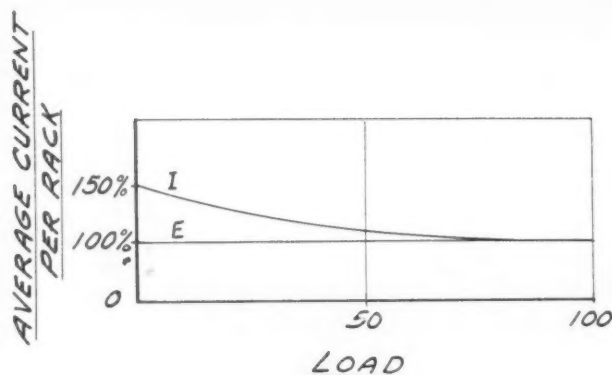


Fig. 1. Automatic Voltage Control.

In the above chart it should be noted that, as the voltage is constant, one rack draws an excessive amount of current. As the tank is loaded, the proper operating condition is obtained.

Once each week

1. Check the oil level and add oil, if necessary.
2. Inspect the oil rings to see that they are rotating and are carrying oil to the journal.

Once every year

1. Drain the bearing chamber completely.
2. Flush with a clean, light oil.
3. Refill with a high-grade medium machine oil.

Most good oil companies can supply a satisfactory lubricating oil for sleeve bearings.

Bearing wear should be noted at regular intervals and the bearings replaced before the rotor strikes on the stator. It is a good plan to carry a spare set of bearings in stock to avoid a shutdown while waiting for new bearings.

Meters, Shunts and Rheostats

In brief, the definition of the ammeter shunt is a low resistance conductor connected in parallel with the ammeter so that the greater portion of the current flows through it.

A low resistance material is soldered or brazed between two machined copper or brass blocks. When full rated capacity is passed through the standard shunt, it will yield 50 millivolts across the terminals. If the shunt is 100 amperes, it will yield 50 millivolts. If it is 500 amperes, it will yield 50 millivolts. If 5000 amperes, it will yield 50 millivolts. Regardless of size, it should yield 50 millivolts at full capacity.

As the ammeter movement will give full scale deflection at 50 millivolts, we can use any 50 millivolt ammeter for any shunt, providing the scale of the instrument corresponds to the rating of the shunt.

Example:

If an ammeter is used with a 100 ampere shunt, we must have a 100 ampere scale. If we have 10,000 ampere shunt, we must use a 10,000 ampere scale. We could use the same ammeter with the 100 ampere scale by merely replacing the scale with a 10,000 ampere reading.

Suppose we use a 3000 ampere shunt and use a meter with a 1500 ampere scale. With a load of 3000 amperes, we would read only 1500 amperes. The same is true if we use a 1500 ampere shunt with

a 3000 ampere meter. With a load of 1500 amperes, we would read 3000 amperes.

The results are obvious. In the first case, the equipment would be overloaded. In the second case, one would have a false reading, which means that the work is getting only half the power required.

The main reason for using external shunts is their weight and size. Shunts weigh from a few ounces to fifty pounds or more. Of course, the latter is impractical.

Rheostats are used to lower the d.c. line voltage to plating or tank voltage. They are made up from a number of resistors in parallel with switches, ammeter, voltmeter and shunt. They are ordered by the capacity in amperes and voltage drop. As an example, 500 ampere — 3 volt drop. The current capacity is derived by the work and the voltage drop is the difference between the voltage source and the tank voltage. If the voltage at the source is 9 volts and 6 volts is required at the tank, the voltage drop would be 3.

In the above rheostat the voltage drop is fixed. Only the current can be varied. For finer control, a carbon pile is used.

The most common causes for rheostat failures are:

1. Voltage drop too low.
2. Overload
3. Poor Contact
4. Defective instruments

Rectifiers

There are now five major dry disc type rectifiers in service today for large current capacities. They are:

1. Magnesium — copper sulfide
2. Copper oxide
3. Selenium
4. Germanium
5. Silicon

MAGNESIUM — COPPER SULFIDE:

For best possible service, units should be connected in parallel, then series for higher voltages. A separate shunt should be used for each rectifier when they are connected in parallel.

Here are a few points on trouble shooting in the magnesium-copper sulfide rectifiers:

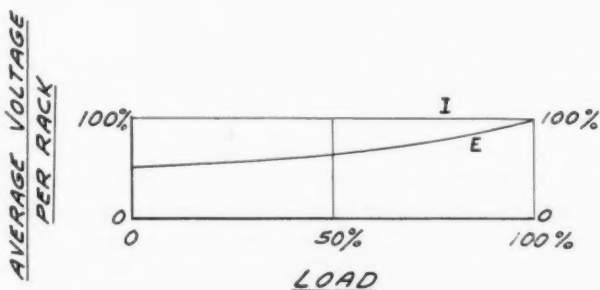


Fig. 2. Automatic Current Control.

In this chart the current is constant but the voltage varies. The work in the tank must be the same at all times. This method is used in strip plating and some methods of anodizing.

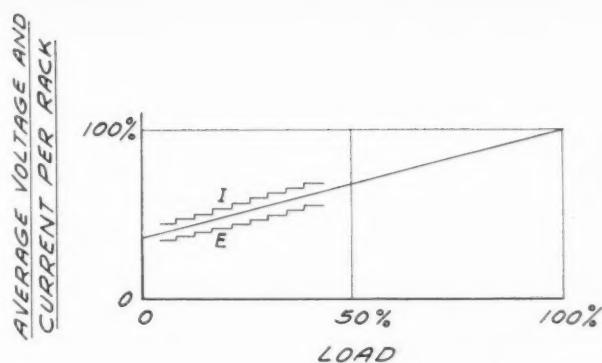


Fig. 3. Automatic Average Constant Current Density Control.

In the above chart the increase in current and voltage is exaggerated for simplification. After the equipment has been adjusted for average constant current density, the operation is simple. When the first rack enters the tank, a certain voltage and current is applied. As each successive rack enters, more current is required, therefore, more voltage is required. This step is repeated until the tank is fully loaded. It will be noted that the curve approaches a straight line. When the tank is unloaded, the power will follow the approximate straight line. Regardless of load, an average constant current density is obtained.

A 1500 ampere magnesium-copper sulfide rectifier for example, is rated at 1500 amperes, 6 volts at full load. At no load, the voltage will rise to 9. If the rectifier is loaded fully and the voltage suddenly drops to approximately three volts, one will find the trouble in the primary, such as a blown fuse, a broken wire, a poor connection, or a burned-out relay. If the voltage drops to about $4\frac{1}{2}$ volts, one will find a poor connection in the secondary. This could be a poor connection at the transformer or at the bottom of one stack. If the no load voltage is 9 and the voltage drops below six with approximately half load, it would indicate a poor d. c. connection, or several poor connections at the bottom of one stack.

Another way to determine the cause of failure is to remove the back panel. After a heavy load is applied, a hand is laid on the stacks. If one stack is hot and the other cold, it means a poor d. c. connection on the cold stack or at least two poor a.c. connections at the bottom of the stack. If the other is excessively hot, it is because this stack is taking all the load. If one section of one stack is cold, it signifies a poor a.c. connection on that section of the stack. If the same sections of both stacks are cold, the trouble will be a poor connection on both stacks or single phase on the primary. In top ventilated models, the heat check can be made while the rectifiers are operating. In side ventilated rectifiers, the test should be made after the power has been shut off and the fans have stopped.

If the voltage and current drop simultaneously, the trouble is in the rectifier. If the voltage raises and the current drops, the trouble is not in the rectifier — look somewhere else.

As there are two stacks in the rectifier, each must deliver 750 amperes at 6 volts when fully loaded. If, after inspection, it is noticed that one stack has warped plates, both stacks should be removed and replaced with new ones. Never install a new stack with an old one and expect good service. As the new stack has a slightly higher d. c. output, it will take a much greater

share of the load and burn up. If it is desired to use the old stack, another old one may be obtained to parallel it. If they will parallel satisfactorily, one may get a lot more service out of the rectifier. If they will not parallel, all that is lost is the labor involved. When stacks fail, usually one will definitely be scrap. The other may have some service left.

When stacks burn up, it is a good practice to check the transformer. If the transformer has been damaged, it will show up after new stacks have been installed. The transformer will not be burned up because of new stacks but because of damage by the previous pair.

This type of stack does not age rapidly. If the stacks are excessively hot and full a. c. voltage is applied and a poor d. c. voltage is obtained, the stacks are aged and must be replaced. This type of stack will operate satisfactorily up to 265°F.

COPPER OXIDE:

This type of rectifier is made in various sizes. The most popular one is 500 amperes at 6 or 12 volts. The units then would be connected in multiples for whatever voltage or current is desired. This unit has an over-voltage device to cut off the circuit in case of extremely high voltage, which could result from full to no load. It may also have a separate fuse link for each cell in the stack.

If a stack goes bad, it allows the a. c. to pass on to the work. In one installation where a plater had six 500 ampere 6 volt units in parallel, he noticed the nickel was poor and tried everything he knew.

In checking, gassing was noticed at the work and, after five minutes, the work was taken out but there was no nickel deposit. The ammeter showed 100 amperes but when an a. c. tong meter and a d. c. tong meter were placed on the d. c. bus, they showed 100 amperes on the d. c. meter and the a. c. meter showed 150 amperes.

Each 500 ampere rectifier was then checked and one was found which allowed the a. c. to pass. Upon removing this unit, the unit resumed plating.

SELENIUM:

Another popular rectifier today is the selenium dry disc type, which is made in various sizes. Selenium stacks became popular because of their light weight and higher efficiency. They can withstand a sudden voltage surge without damage, for example, from full load to no load.

There are two types of stacks used in the stack assemblies. In one case, the manufacturer purchases individual cells and assembles the required number on one rod, if possible. In the other case, the manufacturer uses standard assemblies, and connects these in series or parallel as required. In case of emergency, the manufacturer using the latter method can replace stacks much faster than the first.

Here are a few pointers on trouble shooting in selenium rectifiers:

If the rectifier is fully loaded and the voltage sud-

(Continued on page 73)

BARREL FINISHING

Deburring and Allied Processes

By Arthur S. Kohler, *Frederick Gumm Chem. Co., Inc., Kearny, N. J.*

This is the third and final installment of the series on Barrel Finishing. The preceding parts appeared in the August and September issues, respectively. —Ed.

Having considered the equipment and materials used in the tumbling processes, let us briefly follow the steps in a sample deburring job in a closed barrel. The work is brought to the barrel in tote pans, buckets, drums, etc.; the medium, if any, is in a gondola near the barrel. The work may be added to the medium in the gondola (or may be added separately to the barrel) and the gondola is hoisted into position at the barrel opening. The gondola or pan is hoisted slowly so that the load slides gently into the barrel. The pan is removed and water is added from a hose. Where a non-cutting compound is to be used, generally the load in the barrel is completely covered to the depth of an inch or two by the water. When using an abrasive compound, only small amounts of water are used (about 1 gallon of water for each cubic foot of load). The compound is then added, generally by volume. Most operators have standard scoops, coffee cans or other measures which are used for measuring the required amount of compound. Sometimes, depending on the compound, it may be advisable to mix the compound with water in a pail with a little water to make a thin slurry before adding it to the barrel. The cover is then set in place and locked, and the barrel is started. If the barrel has a variable speed drive, it will be found helpful when deburring fragile parts or parts with sharp corners to run the barrel slowly the first few minutes so that the medium has an opportunity to become mixed with the load while its action is still comparatively mild. Then the speed is increased slowly until, after about 15 minutes, the barrel is tumbling at its normal speed, 15-20 rpm. After the required time, the barrel is stopped and filled with water. The perforated cover is substituted and the load is tumble flushed. The parts may be further processed, or the load dumped into the hoist pan. This is done by slowly turning the barrel forward so that the work and media drops into the gondola. Small barrels equipped with clutches are positioned and tipped by hand, using a length of iron pipe or rod as a lever. Large barrels are generally turned by motor power, by means of an inching switch-brake mechanism. Due to the distance from the gondola and the opening of

the barrel, a small portable chute or hopper may be necessary to guide the load into the pan. The last of the load may have to be raked out with the hands or with a scraper. The pan is then hoisted and transferred to the separating screen, table, etc.

In some instances, instead of dumping the load after the deburring operation, the parts may be treated further in the same barrel, using pickling compounds, burnishing soaps, etc. A sequence of several operations is quite common today and probably will soon become the rule in most cases.

TUMBLE FLUSHING:

This operation is an important one which, unfortunately, is commonly neglected or done carelessly. Its object is to rid the work of grindings, abrasive, and chemicals. Whenever parts are tumbled with abrasives, some of these hard and sharp particles are impacted into the surface of the metal. At times the amount of impregnation is so bad that subsequent operation on the work becomes almost impossible. For example, sometimes parts are drilled, machined or formed after the initial deburring. If the surface is impregnated with abrasive, the drills, milling tools, etc., quickly dull; dies wear out and the cost of sharpening or replacement of tools becomes excessive. If the parts are to be subsequently plated, poor adhesion and porosity of plate may result. Surface discoloration is often due to fine grindings of metal being impacted on the surface.

The only practical way to remove these undesirable surface residues is by tumble flushing. To carry out this operation, the barrel is filled with water and a perforated cover having many $\frac{1}{8}$ " holes (or other suitable screening device) is used to replace the usual door. The barrel is then allowed to tumble so that the sludge and water discharge toward the rear of the barrel. After most of the water has been discharged, the barrel is drained, refilled, and the operation is repeated until the rinse water is quite clean and free of sediment. Usually, three such flushings are sufficient. The barrel is then emptied and the work will be virtually free of all abrasive impregnation.

This tumble flushing is necessary since the combination of mechanical rubbing in the presence of clean water is required to keep the residues in suspension so that they may drain with the water.

Specific Barrel Tumbling Treatments

CLEANING:

Work should be free of oil, dirt, and metal chips before it is deburred or otherwise barrel processed. In some cases, it is easier to do this in the barrel itself. In this operation the barrel may be loaded in the usual manner and an alkaline cleaner added to the load. The load should be tumbled for 5-15 minutes, during which time the oil is emulsified and surface dirt brought into suspension. The barrel is then drained, using a perforated cover and tumble-flushed several times. The work is then ready for deburring, descaling or burnishing.

SHINE ROLLING:

This is similar to cleaning, except that it is usually carried out in three steps and is done mainly with self-tumbling parts. Frequently, for convenience, this is done in an oblique barrel, since a self-tumbling load handles more readily in this type of barrel, because there is no cover needed. Water is added to cover most of the work, a shine rolling compound is added and the parts (most commonly steel) are tumbled for about 10-15 minutes. This operation cleans the oil from the work and peens down edge sharpness. The barrel is then flushed, while it continues to roll, by directing water from a hose nozzle against the bottom of the barrel. The dirt and oil overflow to the floor. The operator may be shielded from splashing by a canvas or plywood screen. When the rinse water is clean, a descaling compound is added, which removes surface oxides and rust. Usually a 10-15 minute descaling treatment is sufficient. Without rinsing, a fresh charge of shine-rolling compound is added for an additional 5-10 minute tumbling. The load is then flushed, drained, and the work transferred to a plating barrel or dried. This operation is well adapted to many parts where complete deburring is not required, but where a moderate sheen and freedom from edge sharpness are sufficient. Frequently, it is used with small stampings, screw-machine parts, and is also suitable for brass as well as steel. There is no grinding action but only mechanical peening and chemical action.

BURNISHING:

This is similar to shine rolling, but is usually performed using a very hard medium such as granite or ceramics which develop a smooth glazed surface. The load is usually completely covered with water and a burnishing compound added. Due to the lubricating action of the compound and the essentially non-cutting character of the medium, the principal action is one of peening or, in some cases, chipping of burrs may occur if these are small and the metal is sufficiently brittle. Generally, this treatment brightens the surface. Treatment time varies from $\frac{1}{2}$ to several hours, depending on requirements. As a rule, the size of medium used is in the range of $\frac{1}{2}$ - $1\frac{1}{4}$ ". Small sizes, because of their mild action, are not very effective for this type of work. Since there is little cutting action, tumble flushing can often be eliminated and the work merely can be rinsed in baskets by dipping.

DEBURRING:

The operation generally implies treatment where a grinding action predominates. Here a cutting type of medium such as aluminum oxide or limestone (for soft metals) may be used either with an abrasive or non-abrasive compound. Where the fastest or heaviest deburring is needed, an abrasive compound is used. Where metallic media such as zinc or steel shapes are used, an abrasive compound is always necessary. Granite and ceramics also require abrasive compounds which, in this case, keep the surface of the stones roughened for cutting. Sufficient water is used to cover the load when working with non-abrasive compounds, but only a small amount (approximately $\frac{1}{2}$ -1 gallon per cubic foot of load) of water should be used with abrasive compounds where maximum cut is desired. It should be noted here that excessive amounts of water thin out the abrasive slurry and retard the cutting action, and too small amounts of water develop a pasty condition which is slimy, acts almost like a lubricant and again reduces the cutting action. After the parts have deburred sufficiently, the work should always be thoroughly tumble-flushed to remove surface impregnations and clean up the surface.

For heavy deburring, the sizes of non-metallic medium range from $\frac{1}{2}$ -1" or even larger at times. Sizes smaller than $\frac{1}{2}$ " are noticeably milder in action and do not grind edges and corners as effectively as the larger sizes. However, for fragile parts and the softer metals, the smaller sizes may be necessary. With metallic medium, $\frac{1}{4}$ - $1\frac{1}{2}$ " sizes are very effective and are suitable for most jobs and metals. Deburring time may vary from $\frac{1}{2}$ hours to as much as 30 or 40 hours although, in most cases, an hour or two is sufficient.

CHIP DEBURRING:

This is an operation which is applicable only to steel, but is used successfully with fairly fragile parts such as slender steel stampings. Here the steel is case hardened to make it brittle on the edges. The parts are tumbled with aluminum oxide medium ($\frac{1}{2}$ -1") with a non-abrasive compound. Due to the brittleness of the burrs, they are quickly broken off and the fine irregular edges are readily ground down to a sufficiently smooth condition. Usually, about a half hour's treatment is sufficient to remove the burrs. The work is rinsed, separated, dried and then annealed, if necessary. The advantage of this method is obvious, since the removal of these same burrs by grinding might require 5-15 hours with regular deburring when the steel is in the soft state. Furthermore, the hardening helps to keep the pieces from bending and being otherwise damaged.

DESCALING:

Where steel parts are rusty or coated with heat-treat scale, it is often practical to remove this oxide by deburring with abrasive medium and compound. However, recesses will not be affected in some cases and, frequently, the process requires several hours time. Often the use of a descaling compound instead of a deburring compound will cut down the rolling time as much as 75%. As mentioned above, descaling



Fine burr grinds easily.



Heavy burr peens over, and must be cut off at the base.

Fig. 12.

compounds are generally acid powders and, when used with steel and some other metals, react to form hydrogen gas. Consequently, this operation must be performed either in an open barrel or one equipped with pressure release valves, vents, etc. In this method the load is generally covered with water and the proper amount of compound is added. Generally, 15-30 minutes tumbling is sufficient and the load should be tumble-flushed well and the parts transferred to the next operation rapidly to avoid rusting. An alternate procedure after descaling is to add a shine rolling compound (which is strongly alkaline) in sufficient quantity to the charge to completely neutralize all of the acid, and continue tumbling for 5 minutes. This will improve the luster of the work and prevent the parts rusting. The work is then tumble-flushed and separated.

MULTIPLE OPERATIONS:

From the preceding discussion, it is obvious that the deburring barrel is capable of performing a whole series of steps, and the trend in recent years has been in this direction. As techniques and compounds have been improved, the deburring barrel ceases to be merely a grinding machine, but becomes a device for removing dirt, oil, rust, scale, tarnish, burrs, unwanted surface roughness, etc., and also for improving the surface finish.

Choice of Methods To Use

In view of the numerous media and compounds available, readers might very readily be bewildered as to which method to employ in a specific case. Actually, this question is not always easy to decide, but certain considerations should be of help in choosing a starting point or providing an understanding approach to the problem.

BURRS:

The size of burrs varies from fine, hair-like edge burrs to thick, heavy ones that are almost flanges. Naturally, the fine ones are readily removed, often within an hour or two, whereas, the heavy ones may require upward of 10 hours for removal. Frequently, the heavy burrspeen flat against a side (Fig. 12) and are removed only by actually grinding through the base of the burr. Heavy burrs are due mainly to dull

cutting tools, worn dies, etc. and, rather than spend excessive time in deburring, it is better whenever possible to have the department which produced the burrs maintain drills and dies in proper condition. While this is not always possible, or easy to accomplish, many companies have learned that cooperation in matters of this kind pay off in the long run and progressive management insists on this as a matter of policy.

PARTING LINES, CUT-OFF TIPS, SPRUES, ETC.:

These projections on castings, screw-machine parts, etc., are quite common, and their complete removal is beyond the powers of the tumbling barrel in most cases. Fig. 13 shows what can be expected from tumbling. Where complete removal is required, the parts should be trimmed with a die, or snagged flush with the surface before being tumbled.

DRILLED HOLES:

Drilled holes are among the more troublesome problems, particularly where small in size. Most of the tumbling medium is large in size, as compared with drilled holes and tends to turn the burr rather than to remove it (Fig. 14). Various methods are used to overcome this condition. Steel parts can be hardened and then chip deburred. In some cases, hand burring may be necessary on small holes which are particularly difficult. The use of small sized medium mixed with large is helpful and completely satisfactory in many cases. When this done, the small medium should be slightly larger than the hole itself so that it does not lodge in it. The use of soft steel pins or wire brads with an abrasive compound will be helpful in some instances. However, the use of sharp drills will be most helpful in reducing the size of the burr, and, consequently, the difficulty in removing the burr. The use of bright dips on brass parts and etches on aluminum sometimes remove burrs so that the barrel operation is used mainly for radius blending and general smoothing.

SLOTS AND BURRED TUBES:

These are almost as troublesome as small holes (Fig. 15). In most cases, they require the use of a

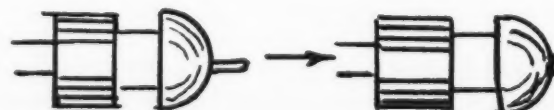
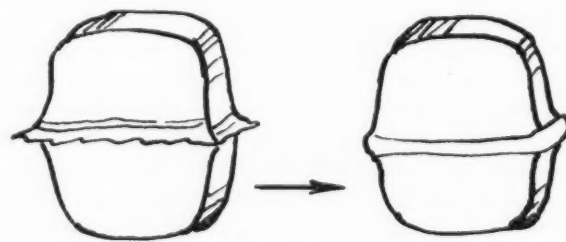
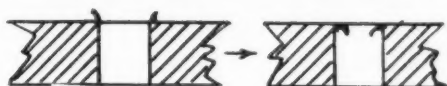
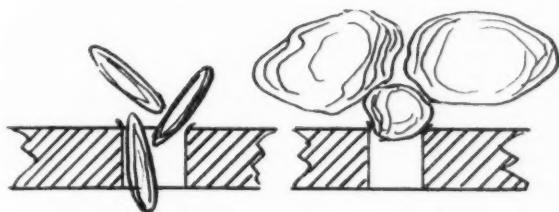


Fig. 13. Parting lines and cutoff tips are not removed without preliminary trimming or grinding.



Burr turns easily into hole.



Steel pins. Small medium mixed with large drilled holes.

Fig. 14.

medium which can pass through the tube or slot, but the medium must be of such size that it is not possible for two or more slugs to pack together in the recess. As a general rule, this can be avoided if the thickness of the medium is less than the width of the slot (or diameter of the hole), but more than half the width or diameter. Flat steel discs are very effective in slots, and cylindrical shapes (such as diagonals) are most effective in tubes.

Effect of Shape of the Parts on the Amount of Barrel Action

Deburring or grinding action does not take place uniformly over the surface of a part due to the mechanics involved. For grinding, it is necessary for an abrasive surface to move across the part under pressure. This is similar to a filing action and, in general, the greater the relative movement and pressure, the more rapid the action. Due to the shape of the part being deburred, some portions of its surface will get more action than others. Fig. 16, while not truly quantitative, roughly approximates the relative amounts of action on various areas.

Thus, it is evident that exposed corners receive maximum action followed in order by exposed edges, convex surfaces, flat surfaces, large radius concave surfaces, small radius concave surfaces and, finally, slots and holes may have no action whatsoever.

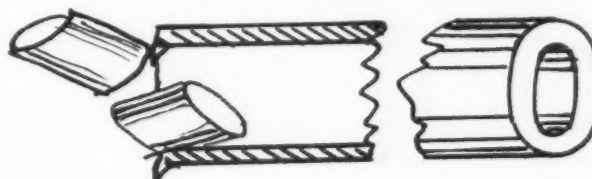
Of course, the proper choice of shapes, sizes, and types of medium can often overcome some of these natural handicaps. Often, a slight change in design can be made, which may overcome some of the difficulties. For example, drilling a hole so that the burr is thrown inside where it may not matter might solve a problem in some instances. Bent steel stampings may be formed so that the burr is thrown up on exposed edges instead of recessed edges. Sometimes stampings are deburred in the flat before bending so that all significant surfaces can be burr-free. The skillful designer, when he becomes aware of these problems, will often be able to develop designs that can be more readily deburred in the barrel.

Surface Finishes

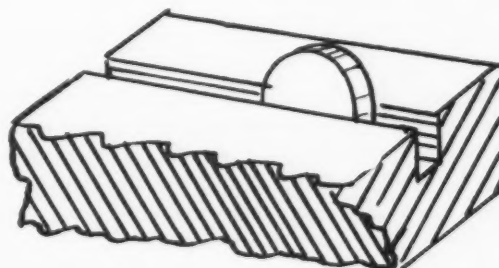
The tumbling barrel is capable of producing a wide variety of surface finishes ranging from a rough matte, depending on the techniques used and the metal being treated. Coarse abrasives produce a very rough finish which is often preferred on parts to be subsequently painted. Such surfaces may range from 50-100 microinches. Finer abrasive gives surfaces of 25-50 microinches. If no abrasive compounds are used, but only cutting medium, the degree of matte will depend both on the medium used on its size. The large sized medium (upward of $\frac{1}{2}$ "), being more vigorous in action, produces moderate matte finishes of 15-30 r.m.s.; $\frac{1}{4}$ " and less may produce 10-15 r.m.s. or even finer. Usually, the latter vary from a fairly bright finish to a light matte appearance. Burnishing stones and ceramics may produce bright finishes, which may still have relatively rough surfaces. Strangely enough, it is possible to have bright shiny surfaces and dull matte surfaces with the same microinch finish. It is possible to produce a matte of about 30 r.m.s. and ball burnish this finish to a nice bright luster and still have practically the same r.m.s. finish. In the case of highly polished steel, a brilliant finish is generally indicative of a low microinch reading. A clear mirror-like reflectance is a better criterion of the fineness of the finish; to have mirror-like reflection, the r.m.s. should approach 5 or less.

Soft metallic slugs, especially zinc, are capable, when used with polishing compounds, of producing finishes of 1-2 r.m.s. even on case hardened steel.

When an abrasive compound or a heavy cutting medium is used, the surface becomes pitted by the abrasive and, when examined under a lens, shows numerous tiny pits and holes. If these are to be removed later, it is necessary to cut away the outer skin using a fine cutting abrasive action. Sometimes a third (or polishing) step may be required. Generally, such a long procedure is not economically feasible.



Diagonals for tubes.



Discs for slots.

Fig. 15.

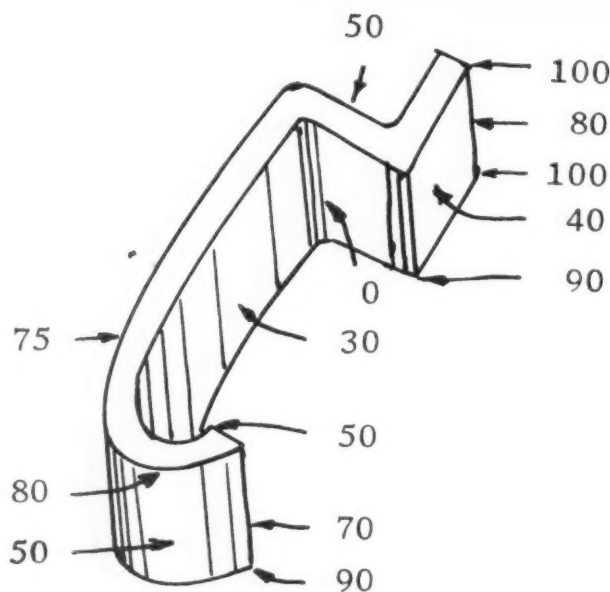


Fig. 16. Relative amounts of action on various surfaces.

ible. The point here is that, where a fine finish is required, an initial coarse deburring treatment should be excluded, since the surface damage done may more than offset any apparent saving of time. In such a case, it might be better to use a fine cutting or polishing procedure throughout.

Barrel Loads

Most installations operate barrels 50%-65% full of mixed load. Occasionally, for large heavy parts, the barrel may be operated with loads up to 85%-90% of barrel capacity. Under the latter conditions, the load does not flow normally, there is a tendency for a dead pocket to form at the center of the barrel, and action is slowed considerably; however, there are fewer collisions between parts and, hence, less damage due to nicking.

There is always a question as to the relation between the amounts of work and medium used. There is no set rule to follow but, if each piece of work is to be completely surrounded by a shell of medium, it is obvious that the total volume of medium must be considerably greater than the volume of work. Furthermore, larger sized media have to be in greater proportion to the work than would be necessary with smaller media. This is obvious, since the larger sized medium forms thicker shells around the work and, also, the action is more violent with less cushioning from the medium itself.

The need for definite medium to work ratios is obvious, since part of the function of the medium is to prevent damaging collisions between pieces. Naturally, the more pieces there are in the barrel, the greater the probability of collisions occurring between the parts. It is natural to try to process as many pieces per load as possible and, where nicking is not objectionable, it is obvious that a low medium to work ratio can be used satisfactorily. On the other hand, many jobs, especially fragile parts, require much higher ratios than average.

In practice, the safest procedure to follow in de-

termining the load ratio for a given job is to make the first runs with a high medium to work ratio, e.g., 10 or 12:1. After a satisfactory operating procedure has been determined, then and then only, should the load ratio be decreased. The reduction should be gradual and parts from each load should be completely processed, plated, etc., and then examined carefully for defects. The ratio is decreased until a point is reached where unacceptable results are produced. This is taken as a limiting value for the ratio, and subsequent production work would operate at a value a little above this.

Load ratios are based on volumes of *random* packed parts and medium. A 4:1 ratio would mean 4 unit measures of medium to 1 measure of parts. When these 5 parts are mixed well, the resulting volume will be, in many cases, not much greater than the volume of the medium, since the medium fills in the voids between the work pieces. For approximation in choosing a barrel for a job, a 3:1 ratio is a fair average value. Allow 60% of the barrel capacity as actual load volume. Then $0.60 \times \frac{1}{3}$ or 0.20 is the work to barrel volume proportion. That is, the load of work would be about 20% of the barrel capacity.

Suggested Methods

Due to the great variations of sizes, shapes, metals, etc., used in fabrication, it is not possible to give any specific instructions. However, the following list covers general methods which are subject to considerable modification from job to job. These suggestions cover the average problems in each instance and may be considered as a starting point for a given job.

ALUMINUM:

Aluminum oxide with a non-cutting compound; granite, ceramics, zinc slugs with a cutting compound. For stampings — time $\frac{1}{2}$ -3 hours. For castings or screw machine parts — time 2-8 hours. CAUTION: Before deburring aluminum in a closed barrel, be certain that the compound used is suited to this metal, since strong alkalis will cause it to become badly pitted and will produce dangerous pressure build-up in the barrel.

BRASS:

Stampings and screw machine parts. Small sized aluminum oxide with a non-cutting compound. Limestone (about $\frac{1}{2}$ -" $\frac{3}{4}$ ") with a cutting compound, followed by a non-cutting compound. Zinc slugs with a polishing compound, followed by a burnishing compound. Time — $\frac{1}{2}$ -2 hours for light burrs, 10-15 hours for smoothing tool marks on screw machine parts.

BRASS CASTINGS:

Marine hardware, etc. Larger sized medium of aluminum oxide, granite, ceramic, steel, with a long lasting cutting compound. Time — 20-30 hours. Several renewals of compound are generally required.

COPPER ALLOYS:

Similar to brass.

CAST IRON:

Similar to brass castings.

LEAD SLUSH CASTINGS:

Generally not deburred but only ball burnished for 10-30 minutes.

STEEL FORGINGS:

Wrenches, pliers:

For general smoothing and radius blending. Larger sized aluminum oxide, granite, ceramics, soft steel with a heavy cutting compound. Time — 8-15 hours.

Cutlery:

Preliminary grinding for smoothing and blending. Soft steel or zinc with heavy cutting compound. Time — 10-12 hours. Finishing after grinding, zinc or soft steel slugs with a polishing compound, followed by a burnishing compound. Time 8-15 hours.

STEEL STAMPINGS:

Lightweight hardware:

For light burrs. Aluminum oxide $\frac{1}{2}$ - $\frac{3}{4}$ inch, non-cutting medium. Time — $\frac{1}{2}$ -3 hours. Granite, ceramic, steel slugs with a mild cutting compound followed by a burnishing compound. Time 1-4 hours.

Heavy stampings:

Larger sizes of above media may be used. Time — 1-8 hours.

STEEL — HARDENED:

Bearings, cutlery, machine parts. For good bright finish or high polish. Zinc slugs with polishing compound followed with a burnishing compound. Time: 3-12 hours. Other media in small sizes may be used in the same way for bright finish.

ZINC BASE CASTINGS:

Limestone (about $\frac{1}{2}$ ") with a non-cutting compound. Time: 3-10 hours. While limestone is most generally used before plating, other media are also used and, when these are lightly colored on a soft buff wheel, produce a nice finish for subsequent bright plating. Rough cutting compounds pit this metal and these pits lead to blisters in the final plate.

Importance of Careful Records

Because of variations in results produced by different operating conditions, job shops have not been too successful in handling deburring jobs except where there are repeat orders on the same parts and where the same procedures are carefully followed from load to load. In manufacturing plants where hundreds of different kinds of parts must be processed periodically, it is very necessary to keep careful records of procedure for each job.

For most satisfactory results, a job should be processed experimentally until the correct combination of medium, compound, technique, etc., have been determined. After this, the full information required should be recorded on a card which should include part number, quantity of work, media, compound, and water, time for each step, barrel size, speed, etc.

Unless all pertinent information is included on the card, and the operators carefully trained to follow the instructions intelligently, there will be variation from batch to batch.

MAINTENANCE OF ELECTRICAL EQUIPMENT

(Continued from page 67)

denly drops to half, look for trouble in the primary, such as a blown fuse, a broken wire, a poor connection, or a defective overload device. If the voltage drops one third, look for a poor connection in the secondary circuit, such as a poor connection at the transformer or at the stack. If the voltage drops gradually, this is a sign of stack aging. This will show up in greater power being used for the amount of d. c. rectified, and the stacks will get hot. Normally the selenium stacks are warm.

If white metal that looks like solder is noticed at the bottom of the stack, at the bottom of the rectifier cabinet, or on top of the transformer, (if it is directly under the stack) it means the stacks have been overheated and are useless.

An overheated d. c. connection means a poor connection. If the rectifier has several standard stack assemblies in parallel and some are cold, look for a poor stack connection, either on top or bottom of the cold ones.

If the bus to the tank is of the proper capacity and it is hot but the meter does not read properly, check the meter and shunt. The shunt capacity must be the same as the meter scale and the millivolts must also correspond. The meter may be defective. If the voltage rises and the current drops, look for trouble outside the rectifier. If the voltage and current drop simultaneously, look for trouble inside the rectifier.

If the stacks must be replaced, it is advisable to replace all. If one new section is installed, it will tend to take all the load, destroy itself and one will still have some old stacks.

GERMANIUM:

Germanium is one of the latest semi-conductors to be used for heavy rectifying power. Its capacity is determined by the amount of heat generated and which can be radiated and cooled. This can be done by air, water, heat exchanger, oil cooling.

The efficiency of the cell is 99%. Overall maximum efficiency of oil cooled is 94%, air cooled up to 92%, depending on voltage. The reason is that a high voltage cell must be used for low voltages. The power factor is 92% if a tapped auto-transformer, powerstat (or equivalent) or induction regulator is used. If saturable reactor is used, the power factor will be less.

If a cell fails, it must be removed from the line within one cycle. If not, the entire group will destroy itself. Ordinary fuses will not give protection.

There is no aging. If a cell fails, it can be replaced by another cell of equal forward voltage drop and the rectifier is then back to normal.

SILICON:

Silicon is now coming on the market to compete with

germanium. Its characteristics are the same as germanium except the efficiency is 2% less and the operating temperature of the cell is higher.

Regulation

Regulation can be obtained in several ways, manual, remote, and automatic. The manual regulator can be a powerstat, (or equal) or a tapped auto-transformer with tap-switches. Recently the tapped auto-transformer has been equipped with a motor driven tap switch, permitting the regulator to be an integral part of the rectifier, depending on the size of the installation. This means that only the control panel need be mounted near the operator. The panel can be manufactured for either remote or automatic control, saving valuable floor space. Remote control can also be obtained with motor driven powerstat, motor driven induction regulator and saturable reactor with magnetic amplifier.

In the powerstat and induction regulator the ripple and power factor are not affected. The saturable reactor with magnetic amplifier will give a ripple of 6 to 32% depending on the load. The smaller the load, the greater will be the ripple. This high ripple is detrimental to some types of plating.

The power factor is also affected. Some manufacturers correct this with capacitors, which also increases the cost. The power rate is usually determined by the power factor.

Automatic cycle control may be desirable for some applications such as chromic acid anodizing and for striking. Recently it has been found that chromium plating with conventional baths can be improved by using a three volt strike automatically. The rack will enter alive with approximately three volts, the strike voltage applied for a few seconds, then the plate voltage is applied. This has proven very beneficial in pieces that have a low current density area.

Finishing Pointers

Diffused Nickel — Cadmium Deposits

By Harry J. West, Ch. E.

Elkhart, Ind.

THIS metal finishing process is primarily to prevent corrosion of carbon and the low alloy steel parts which may operate at temperatures up to 900°F. The process is not suitable for use on parts of complex shape where minimum nickel plate thickness requirements cannot be met, and on parts whose hardness would be reduced below drawing requirements by heating at 640°F.

All brazing or welding must be completed before parts are plated. Parts having hardness higher than Rockwell C 40 and which have been ground after heat treatment should be suitably stress-relieved before cleaning prior to plating. Temperatures to which parts are heated should be such that maximum stress relief is obtained without reducing hardness of parts below drawing limits.

Parts are cleaned same as for electroplating and prepared for nickel plating. The nickel bath should be a chloride or sulfate-chloride solution containing no addition agents which might have a detrimental effect on the properties of the deposit or the basis metal. A recommended formula for nickel is as follows:

Nickel sulfate	36-40 oz./gal.
Nickel chloride	8-16 " "
Boric acid	4 " "
pH	3.5-4.5
Current density	40-60 amp./sq. ft.
Temperature	110-130°F.
Thickness	0.0002-4"

After nickel plating, parts must be rinsed thoroughly, neutralized in alkali and transferred directly to the cadmium plating solution. This is the common cyanide solution consisting of the following:

Cadmium metal	2.5-4.5 oz. gal.
Free cyanide	7.0-11.0 " "
Sodium hydroxide	1.0-2.0 " "
Temperature	Room
Current density	10-15 amp./sq. ft.
Thickness	0.0001"

In most cases, especially in aircraft parts, a chromate dip is required, mostly to eliminate fingerprint staining.

One must be sure that the cadmium deposit is not more than half the amount of nickel plate; for example, when 0.0004" nickel has been deposited, not more than 0.0002" cadmium can be deposited. Actually 0.0001" is sufficient to obtain a good diffused condition. An excess of cadmium will cause balling and rejection of the part.

The actual diffusion is done at 630°F. for 30 minutes to 1 hr. However, to assure a good diffused part, the temperature of the oven should be lowered to about 200°F. and gradually raised to 630°F. over a period of about 15-30 minutes, then held at 630°F. for 30-60 minutes. Since 630°F. is near the melting point of the cadmium, if the part is subjected to this temperature immediately the cadmium will have a tendency to melt before diffusion can take place, which will cause balling and small pimples of fused cadmium will show on the surface. The finished plate after diffusion should have a dull matte finish, usually gray to black in color and smooth to the touch.

After diffusion, parts must resist heating in air at 700°F. for 23 hours, followed by heating at 1000°F. for 1 hr., without blistering or cracking on significant surfaces. Appearance of a loose powdery film which can be wiped off is not cause for rejection. No corrosion should show after being subjected to 100 hr. salt spray test.

Science for Electroplaters

29. Cyanide Disposal Methods

By L. Serota

THE need for adequate and safe disposal methods for cyanide wastes is being increasingly stressed by various agencies, federal, state, and municipal. In directing their efforts toward pollution abatement, they are defining in more precise terms the necessary conditions for such treated effluent, prior to discharge into public bodies of water. The Ohio River Valley Sanitation Commission refers to the legal and moral responsibility of metal finishing plants to the extent that discharge of waste will not interfere with the reasonable use of a stream. Treatment processes for cyanide wastes are further complicated by such governing factors as variation in volume and composition or concentration of waste, location of plant, disposal to sewer or stream, economic and engineering phases of plant design.

J. G. Dobson in METAL FINISHING (1947) indicates the general magnitude of cyanide concentration for various types of wastes by the following examples (Table I). The market difference in cyanide concentration indicated in the table, between plating rinse water, which may include non-overflow reclaim rinses or continuous-overflow rinses and dumped plating baths, shows clearly that chemical methods suitable for the treatment of concentrated solutions cannot apply to the more dilute rinse waters because of the inefficiency of chemical reactions at these lower concentrations. In addition, the economic aspect of the large physical installations neces-

sary for the treatment of these very dilute solutions would make such methods impractical.

Dilution

The method that seemingly provides the simplest procedure would be direct discharge into stream or sewer, where the dilution ratio may be sufficient to eliminate toxicity. To appreciate the extent of dilution required to make cyanide waste non-toxic, it could be indicated that seven million gallons of water are necessary to dispose of one pound of sodium cyanide. J. E. Cooper, for example, reports that this method of sewer disposal of cyanide wastes is possible in Detroit, Mich. owing to the large daily dilution volume (more than 400 million gallons). A further advantage given by Cooper is the fact that the sewage treatment plant for Detroit is a primary type which does not include sludge digestion, the process most generally affected by plating waste. This disposal method does require, however, for areas where conditions are not as favorable as those at Detroit, rigid control of the waste discharge and concentration as well as suitable regulation of waste dilution and mixing.

Another example cited by Cooper relates to disposal of low-concentration cyanide rinse waters by dilution through the sewer system of a small community. Such procedure is in operation at the Ypsilante, Mich., plant of the Ford Motor Co. Instead

of discharging the dilute rinse waters into the Huron River, as was previously practiced, the waste is now directed through the sewer, which provides an additional 40 to 1 dilution ratio. This method serves to introduce an added safety factor when the effluent empties into the river. It was noted that no harm occurred to the sewage plant for the two year period of this procedure. B. F. Dodge and associates indicate, in A. E. S. Research Project No. 10, that a higher cyanide waste concentration is permissible in sewage, with a tolerance as much as 3 ppm. CN or more based upon the dilution ratio, compared to that allowed for streams, where recommendations for permissible concentrations are as low as 0.01 to 0.02 ppm. CN, with an occasional higher tolerance of 0.5 ppm. CN. Conditions affecting a stream, such as seasonal dilution or flow, or location of a plating plant with respect to other plating plants along the stream, are additional factors that must be considered in cyanide waste discharge. A case for such condition was reported by C. K. Calvert in the procedure of the First Industrial Waste Utilization Conference at Purdue University. The presence of cyanide, 4 ppm., in White River, 24 miles upstream was found to be the cause of a large number of dead fish. The time required (in November) for the stream to reach the water works headgate (125 hours) was sufficient to reduce the cyanide concentration to a value below 0.5 ppm. Dilution was considered a contributing factor. Minnows which were used as test animals, because this species is sensitive to less than 0.5 ppm. CN, continued to live at this point.

In another instance, reported by A. Karsten, trout were found dying in a Black Hills stream, after a severe winter, fifteen miles below a plant which discharges waste into the stream daily, where previously the poisonous effects had not reached further than two miles from this plant. Since the daily cyanide discharge was not varied, the condition was attributed to an increase in cyanide concentration due to the excessive freezing of the water that year and the probable formation of a cyanide cryohydrate which would have a lower melting point than ice. Upon thawing in warm weather, the increase in cyanide concentration downstream, was sufficient to kill the trout. A cryohydrate is a mixture of ice and a salt, in this instance potassium or

Table I

Type	Concentrations	As
Plating Rinse Water	1 to 25 ppm.	NaCN, AgCN, and other metal cyanides
Dumped Plating Baths	10 to 100,000 ppm.	Various metal cyanides
Heat Treating Quench Waters	50 to 100 ppm.	Sodium cyanide, sodium ferrous cyanide
Coke Oven Gas Scrubbing Water	150 to 300 ppm.	NaCNS
Mine Tailing Rinses	5 to 25 ppm.	NaCN

sodium cyanide, which represents the lowest freezing point attainable for this solution. It is called the "cryohydric" or "eutectic" point.

The opposite condition, noted by Dobson, may occasionally prevail where the receiving stream or intercepting sewers are contaminated to such an extent that discharge of rinse water which may contain 3-5 ppm. of cyanide will not be objectionable. Dobson also emphasizes the need of treating cyanide wastes before discharge into sewers or streams leading to rivers which later serve as a source of drinking water.

Complexation

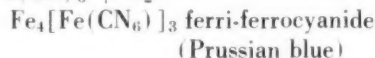
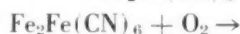
Where the dilution method for reducing pollution from cyanide rinse wastes is not applicable, disposal by the formation of complex metal cyanides was proposed as a possible treatment by *D. Milne*. The elimination of silver, mercury and cobalt as complexing agents is based on cost, in the case of silver, or absence in common plating baths of the other two metals. Copper, cadmium and zinc are ruled out since these ions in cyanide plating baths are intended primarily for metal deposition. Of the remaining metal ions that may be considered suitable for the formation of stable complex compounds iron (ferrous and ferric) and nickel offer the best possibilities.

The ferrocyanide and ferricyanide complexes are quite stable and will not decompose to form hydrocyanic acid and an iron salt (unless heated) upon the addition of strong (mineral) acids. Milne attributed the relatively poor results in yielding a less toxic compound with ferrocyanide complexation to the equilibrium (dissociation) factor and solubility of the precipitate. For example, iron present in rinse waters from pickling processes would, upon neutralization, yield the ferrous and ferric hydroxides. Hydrolysis would shift the equilibrium in the direction of the cyanide ion. The ionic equations representing this equilibrium are as follows:



It is evident that an increase in the hydroxyl ion concentration will shift the equilibrium for the reversible reaction to the left, thereby increasing the cyanide ion concentration. It is important, therefore, that a suitable pH value be determined (control of

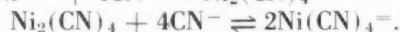
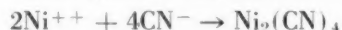
the hydroxyl ion concentration) for satisfactory operation of this method. The author indicated that an additional troublesome factor in the application of this treatment method is the formation of the Prussian blue (ferri-ferrocyanide) precipitate resulting from the oxidation of the ferrous ion. This compound would add an unfavorable blue tint to the water. The ionic equations for the iron complexes follow.



J. E. Cooper reported on laboratory tests conducted at the Ford Willow Run disposal plant on a ferrous sulfate and lime method (in absence of air), in use in England, for which the claim was made (on the basis of laboratory tests) that a potassium cyanide solution containing 408 ppm. HCN may be reduced to 0.4 ppm. in 4 hours. The process was not developed at Willow Run because the reaction rate with the metal cyanides was too low. *B. F. Dodge* added the view that the presence of complex metal cyanides in treated solutions adds a questionable factor to the iron cyanide complex formation method.

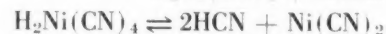
Nickel Cyanide Complex

The use of nickel rinse as a complexing agent for cyanide rinses was suggested by *D. Milne* as holding promise because such solutions are generally buffered and have a higher pH than that of pickling rinses. Nickel cyanide, which is insoluble, will react with free cyanide to form the nickel cyanide complex.

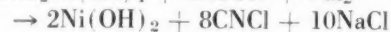


If a precipitate results, then free cyanide may be considered absent. This method, described by Milne for removing free CN, was to allow the waste to flow over a sludge bed containing precipitated nickel cyanide. Data recorded on a plotted curve indicate that 80 ppm. of this nickel cyanide complex may be present before 0.15 ppm. of free cyanide will result from dissociation. The complex will therefore yield a sufficiently low concentration of free cyanide so that it will be non-toxic to fish life. Goldfish kept in a solution containing the nickel cyanide complex at a pH of 8.1, which analyzed less than 3 ppm.

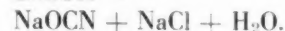
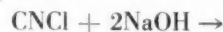
CN (*Liebig Method*) showed no harmful effect after 24 hours compared to the same size fish used as control. An objection to this method, noted by the author, is the decomposition of the stable nickel cyanide complex by strong acids, yielding hydrocyanic acid. This is due to the fact that nickelocyanic acid is an unstable weak acid.



A second objection is based upon the fact that chlorine will affect the nickel cyanide complex, because of the formation of cyanogen chloride in alkaline solutions.



Water, if alkaline however, may convert the cyanogen chloride to the cyanate.



Ponding

The process of simple ponding, where space permits, is used occasionally as an inexpensive method of disposing of cyanide waste. The cyanide concentration in shallow ponds is found to decrease and gradually disappear, the rate of volatilization of hydrogen cyanide from such waste disposal ponds depending upon the pH of the diluted waste. Plating cyanide wastes which are decidedly alkaline (unless mixed with acid wastes) will decompose at a very much slower rate than that of a neutral or acid (waste) solution.

Fig. 137 is a graphical representation of such (qualitative) results based upon data gained by investigators, as part of A. E. S. project #10. A sodium cyanide solution, main-

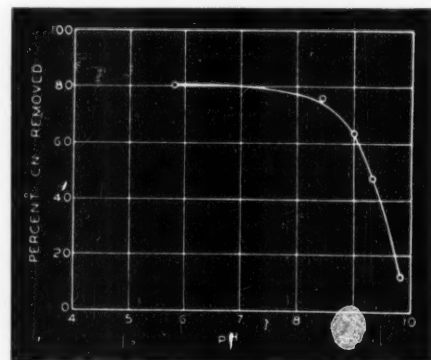


Fig. 137. Effect of pH on the evolution of HCN during 22.3 hours from a stagnant 6½" deep sodium cyanide solution at 74-80° F.

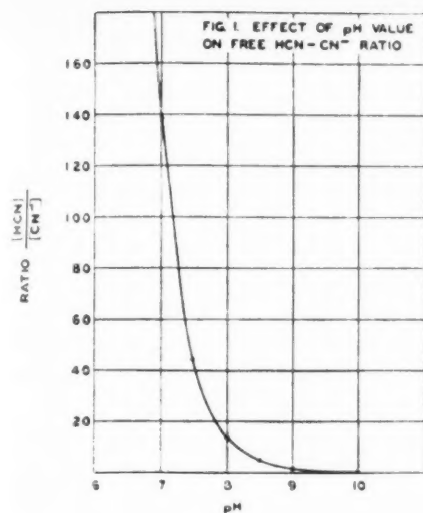


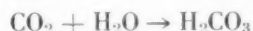
Fig. 138.

tained at a temperature of 74°-80°F. in a 6½ inch stagnant pond corresponding to a waste-disposal pond, was observed for 22.3 hours to determine the effect of pH on the evolution of hydrogen cyanide. Metalocyanide complexes were not included in the solution. The graph shows that, with the cyanide proceeds in the same manner as that for a simple cyanide salt solution. The graph shows that, with the lowering of pH from a value of 10 to about 6, an appreciable increase in the percentage of hydrogen cyanide removed will result for solutions of equal cyanide concentration, a development attributed to the greater percentage of total cyanide present as molecular hydrogen cyanide at this lower (acidic) pH. This ratio is indicated in Fig. 138. Another factor indicated in the graph is the negligible change (increase) in the rate of evolution of hydrogen cyanide that will result if the pH is lowered below 6 since, at this pH, the cyanide present is almost entirely in the molecular form. Based on calculations, more than 99 per cent of (total) cyanide is present as molecular hydrogen cyanide when the pH of a solution containing free cyanide is reduced to 6.5. The remaining free cyanide in solution will be the small amount which is in equilibrium with complex metal cyanide ions and precipitated metal cyanide.

Depth of a ponding solution was also cited as an important condition affecting the rate of escape of hydrogen cyanide, because of the low rate of diffusion of hydrogen cyanide in water, which is about 1/10,000 that in air. The hydrogen cyanide molecules, accordingly, require a longer

time (rate) to diffuse to the surface, from lower depths, as replacement for the escaping molecules. Regional climatic conditions are an added factor governing changes in ponding solutions.

The loss of cyanide in ponding is attributed to the absorption of carbon dioxide from the air (air usually contains about 300 ppm. carbon dioxide) and the formation of carbonic acid which replaces the weaker hydrocyanic acid. Milne suggested the following chemical changes as an explanation for the loss of the hydrocyanic acid:



The liberated hydrocyanic acid escapes into the air as hydrogen cyanide or is changed to ammonium formate (HCOONH_4) by hydrolysis. The Orsanco manual *Methods for Treating Metal-Finishing Wastes* (1953) indicates that doubt exists as to whether complete oxidation of the cyanide occurs.

When sodium bicarbonate forms, as shown in the last equation, the pH of the solution will be about 8.3, at which point the ratio of hydrocyanic acid to the cyanide ion increases to about 7:1. The relationship between pH and hydrocyanic acid cyanide ratio is shown graphically in Fig. 138. The free hydrocyanic acid, it will be noted, increases rapidly as the pH is reduced from a value of 10. The additional absorption of carbon dioxide will not change the pH appreciably, owing to the existence of the carbonic acid — bicarbonate buffer system. The graph shows, however, that a slight decrease in pH value at this stage will result in a large change in the hydrocyanic acid — cyanide ion ratio. Milne indicates that the pH would be 6.5 at the equimolar concentrations of carbonic acid and bicarbonate ion.

L. F. Oeming referred to experiments conducted by the Michigan Institute of Fisheries Research which indicated that, when cyanide removal by conversion to sodium thiocyanate is incomplete, reduction of residual cyanide may be attained by ponding the treated effluent for a long period.

L. W. Wise suggested that ponding will reduce cyanide waste concentration from 100 ppm. to 5 ppm. by acidification to a pH of 3.0 and exposure of the waste for 48 hours in

baffled ponds two feet deep. Longer exposure and shallower ponds will further reduce the cyanic concentration.

The ponding process is generally considered unfeasible because of the danger of poisoning to animals and humans by pollution arising from seepage of the cyanides to underground water supplies or streams. An unfavorable economic factor that must also be considered is the need for extensive ground areas for pond use. The simplicity of the operation, however, and the fact that no chemicals are required for treatment, are major advantages in cases where the method is applicable.

Lime-Sulfur Method

Sulfur and polysulfide compounds may be used for the conversion of cyanide in wastes to the less toxic thiocyanate, NaCNS . The use of a lime-sulfur mixture for the treatment of cyanide was patented by Werlund and Gunick in 1938. The commercial product, consisting of 70 per cent calcium polysulfide, (J. R. Partington gives the formula for the crystals as $\text{CaS}_4 \cdot 3\text{Ca}(\text{OH})_2 \cdot 9\text{H}_2\text{O}$ and CaS_2 to CaS_7 in solution), 5 per cent calcium thiosulfate $\text{CaS}_2\text{O}_3 \cdot 6\text{H}_2\text{O}$, and 5 per cent free sulfur, is added to the cyanide waste solution and the mixture heated to near boiling. Oeming, in referring to the patented method used by Dupont, listed the addition of 1.84 pounds of lime-sulfur per pound of sodium cyanide. At room temperature, reaction time was 2 hours and, at boiling, one-half hour. The reaction was not complete, and ponding was employed for final reduction of the cyanide. Hydrogen sulfide is indicated as being produced in this reaction, and its removal is recommended by aeration or acid. Dobson also referred to the problem of hydrogen sulfide liberation when such effluent reaches acid conditions in sewers. This gas, in addition to being toxic, is highly corrosive to metals. If cyanide waste effluent, after lime-sulfur treatment, is discharged into low pH sewage and chlorinated at the sewage treatment plant, the toxic hydrocyanic acid or cyanogen chloride (CNCl) is formed, depending upon the pH.

Experiments conducted by the Michigan Institute of Fisheries Research show that commercial sodium thio-

(Continued on page 79)

SHOP PROBLEMS

ABRASIVE METHODS SURFACE TREATMENTS CONTROL
ELECTROPLATING CLEANING PICKLING TESTING



METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Plating Crankshafts

Question: I am contemplating the establishment of a "hard chrome" shop in this city, the main operation of which is to be the chroming of gasoline and Diesel engine crankshafts; however, I have been unable to find any concrete information concerning hydrogen embrittlement effects in this particular application. In the GUIDE-BOOK it is stated in effect that the embrittlement can be largely removed by heating at 500°F. for a length of time proportional to the size of the piece.

My question is, is there a treatment which would relieve the embrittlement in the crankshafts to such a degree that there would be no failure in operation due to this cause or that of destroying the properties of the shaft through severe heat treatment in removing said embrittlement? Also, would the application of appreciable thicknesses of chrome, say 0.050 inches, be inherently impractical? I intend to use the 33 oz./gal. CrO_3 formula at 130°F. with only solution agitation.

W. N. R.

Answer: There can be no guarantee that a chromium plated crankshaft will not fail in service, due to hydrogen embrittlement. However, the heat treatment will remove most of the hydrogen and there would be only a very slight possibility of such failure. The baking temperature is too low to have any effect on physicals of the steel itself.

It is not considered practicable to apply more than about 0.015-0.020" of chromium, as heavier deposits have a tendency to crack excessively. This is, of course, chromium thickness, and the increase in diameter will be twice as great.

Testing Deposit Thickness

Question: We will appreciate very much any information you can offer on methods of determining the thickness of chromium deposits on ferrous metals. We are presently attempting to do this by means of a magnetic-type gage, but find our readings inconsistent.

Our problem is to deposit a minimum of 0.002" hard chrome on a very irregular-shaped steel forging, which must be finished with a 120-grit-blast surface prior to plating, with no further finish after plating. We have determined by various measuring methods that the deposit of chrome is well in excess of the 0.002" required. When the gage is checked with the test specimens supplied with the gage, it will invariably indicate exact thickness of chrome deposited on the test samples. These test samples supplied with the gage have a mirror finish.

Does the surface finish affect the reading of this type gage? What other conditions have you found that might exist in the chrome deposit or in the parent metal itself that might influence the force required to break the magnet, thus erroneously indicating the thickness of the deposit? Are there more efficient methods of making this test?

J. F. H.

Answer: Magnetic type gages, as well as eddy-current types, are liable to be inaccurate unless the surface is fairly smooth. This is very understandable when it is considered that surface irregularities will affect the distance between the magnet and the steel base, with resultant effect on the magnetic attraction.

In the case of hard chromium de-

posits on steel, this would be the only factor affecting the results, and would be present in the case of any magnetic or eddy current type of instrument.

It is suggested that a small spot be polished smooth before plating, and measurements made at this spot after plating. Less accurate, although possibly satisfactory, results may be obtained by preparing standards with a grit blast finished base. There are other methods for determining the thickness but they would involve removal of the deposit.

Iron-Zinc Alloy Bath

Question: Kindly forward all technical information and formula for zinc iron plating.

A. C.

Answer: Iron-zinc alloy deposits can be produced from an acid sulfate bath of the following composition:

Ferrous sulfate	40 oz./gal.
Zinc sulfate	1.4-17.5 oz./gal.
Ammonium sulfate	19 oz./gal.
Potassium chloride	1.6 "
Citric acid	0.08 "
pH:	1.7 - 2.0
C.D.:	200 amp./sq. ft.
Temp.:	120-176 deg. F.

The lower zinc sulfate content will produce an alloy containing about 6% zinc at the lower temperature, while the higher zinc content at the higher temperature will produce a deposit containing about 65% zinc.

Electropolishing Cast Iron

Question: Can you suggest a formula for electropolishing iron castings and nodular cast iron?

J. M. P.

Answer: A formula suggested by DeSy & Haemers for nodular cast iron is the following:

Perchloric acid	70 cc.
Ethyl alcohol	800 "
Water	130 "
Room temp.	10-15 volts. 600-1,000 amp./sq. ft.

Electropolishing solutions contain-

ing perchloric acid present an explosion hazard in the presence of organic matter. Unfortunately, most formulas for cast iron are of this type.

The patent literature discloses a large variety of acid baths, claimed to be suitable for cast iron among other metals, but we cannot advise as to their effectiveness. A Japanese patent suggests alternating current at about 2,000 amp./sq. ft. in a solution of 4-14 oz./gal. potassium cyanide.

Lead-Silver Solution

Question: Would you please give us the procedure on lead-silver plating, solutions, time, etc.

D. W. S.

Answer: The only commercial bath for depositing lead-silver alloys is a cyanide-tartrate bath employed for bearings and producing deposits of 3-4% lead content. The following solution was suggested by Faust & Thomas:

Potassium tartrate ...	47 g./L.
Potassium cyanide ...	22 "
Silver cyanide	30 "
Caustic potash	1½ "
Basic lead acetate ...	4 "

The solution is operated at room temperature and up to 15 amp./sq. ft. current density. Anodes are 96.2% silver; 3.8% lead and are operated at about 5-10 amp./sq. ft.

Copper in Pickling Solution

Question: We are pickling hot rolled steel in an 8-12% solution of H₂SO₄ at 160° — 190°F. The steel is hung on copper alloy hooks and the solution becomes contaminated with copper in a short time, thereby causing a deposition of copper on the steel.

We have three tanks in line: acid, cold rinse and hot rinse, with no room available for more dips. I have tried various amounts of nitric acid in the pickle tank, hoping to take up copper, with no avail. Can you suggest a means of removing copper, other than changing hooks? Can copper be dummied out in a side tank, comparable to purification of a nickel bath?

After fabrication of the steel, it is cleaned, rinsed, pickled in 10% H₂SO₄ for two minutes, rinsed, reverse cleaned in a solution composed of 4 oz./gal. NaCN; 4 oz./gal. NaOH, for two minutes at 180°F. (time cannot be increased), rinsed and plated in conventional zinc bath.

C. A. C.

Answer: Copper can be removed by immersing scrap iron in the pickling tank. The copper will deposit on the iron by displacement, which will increase the iron content of the pickle slightly.

It can also be removed by electrolysis, using lead or graphite anodes and stainless steel cathodes, but this will require a special installation including an electrolyzing tank and d.c. current source. However, electrolysis can be performed on a continuous basis in a separate tank, the pickling acid being pumped out of the treatment tank, through the heat exchanger, and into the pickling tank from which it can be syphoned over. If the voltage in the caustic-cyanide tank is lowered to about 1½ volts, the thin film of copper should dissolve.

Of course, use of Monel or stainless steel pickling hooks will eliminate the copper contamination.

SCIENCE FOR ELECTRO-PLATERS

(Continued from page 77)

cyanate is 600 times less toxic than potassium cyanide. A report by G. M. Ridenauer indicates that a high limit of tolerance of polysulfide or thiocyanate is permissible in activated sludge processes. Recovery of normal purification activities was usually rapid (2 days) in the presence of excessive amounts.

In a private communication, F. E. Watts of the Hamilton Division of United Aircraft Corp. reported that the lime-sulfur method for treating cyanide wastes was used successfully on a small operating scale, with treatment not in excess of 50 gpm. for a period of about eight years at the Windsor Locks Connecticut plant. Difficulty in gaining state and municipal approval for a large scale installation led to the substitution, in 1951 of the chlorine treatment method.

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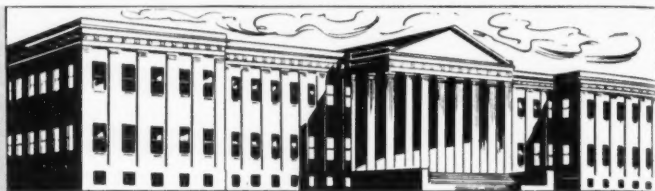
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Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD



Bright Nickel Process

*U. S. Patent 2,784,152, March 5, 1957.
D. G. Ellis, assignor to the Harshaw
Chemical Co.*

A method of electrodepositing nickel in the form of a deposit which is bright as taken from the plating solution without further treatment, which method comprises electrolyzing an aqueous acid solution of a nickel electrolyte of the class consisting of nickel sulfate, nickel chloride, and mixtures of nickel sulfate with nickel chloride, said solution also containing cooperating addition agents capable of imparting brightness to the deposit, one of said addition agents being a compound of the form $\text{ArSO}_2\text{—}$, where Ar represents an aromatic radical containing not less than 6 nor more than 10 carbon atoms in the aromatic nucleus, such compound being dissolved in said solution to the extent of at least 0.2 gram per liter and the other of said agents being a compound of the form $\text{R}(\text{CH}_2\text{CH}_2\text{O})_n\text{H}$, where n is an integer from 10 to 100 and R is a radical selected from the class consisting of radicals of the form $\text{R}'\text{O}$ and $\text{R}'\text{NH}$ where R' is selected from the class consisting of hydrogen, alkyl radicals having from 1 to 20 carbon atoms, and aryl radicals having from 1 to 20 carbon atoms, said last mentioned addition agent being dissolved in said solution to the extent of from 0.001 to 0.05 gram per liter.

Degreaser

*U. S. Patent 2,783,975, March 5, 1957.
I. L. Lans, assignor to Metalwash Ma-
chinery Co.*

A cooling water arrangement for a degreaser comprising a main tank and a side tank in communication with each other, an external water jacket surrounding said main and side tanks, a baffle within said water jacket, an inlet in said jacket on one side of said baffle, an outlet in said jacket on the other side of said baffle, an elongated vertically disposed helical condensing coil mounted within the top of said side tank and exposed to the vapors of degreasing solvent to be condensed, an

inlet for said coil, and an outlet for said coil.

Corrosion Preventive

*U. S. Patent 2,784,104, March 5, 1957.
M. S. Baseman, K. S. Johnson and S.
E. Baseman*

A homogeneous corrosion-inhibiting composition suitable for application to damp and wet metal surfaces, consisting essentially of a solution of from 75% to 99.8% by weight of a liquid oleaginous vehicle consisting essentially of a hydrocarbon lubricating oil of a viscosity of below 50 poises at 25°C., from 10% to 0.1% by weight of a hydrophilic wetting agent dissolved in the vehicle, the wetting agent being selected from the group consisting of petroleum sulfonates, sorbitan monolaurate, sorbitan monopalmitate, sorbitan monooleate and sorbitan monopalmitate polyoxyethylene derivatives, and from 15% to 0.1% by weight of the reaction product of substantially equimolar proportions of dicyclohexylamine and octanoic acid.

Bias Buff

*U. S. Patent 2,783,594, March 5, 1957.
A. S. Rock, assignor to F. L. & J. C.
Codman Co.*

A method of making buff sections which comprises superposing a plurality of lengths of fabric with aligning edges, cutting diagonally across the assemblage to sever therefrom an oblique parallelogram, folding in corners of the parallelogram to bring said sides into abutting relationship, again folding the resultant pad along the line of said sides to superpose them for the operation of a sewing mechanism thereon, joining such superposed edges only by a single overcast seam which permits their return to aligned position to provide an open-ended multi-ply sleeve with its plies joined against relative movement longitudinal of the sleeve, severing said sleeve into a plurality of ring sections each of a width once or twice the said radial depth and deforming each ring section into an annulus.

Corrosion Preventive

*U. S. Patent 2,783,204, Feb. 26, 1957.
J. P. McDermott, assignor to Esso Re-
search and Engineering Co.*

A petroleum hydrocarbon product containing dissolved therein a corrosion inhibiting amount of a condensation product obtained by condensing an alkylene oxide containing 2 to 6 carbon atoms per molecule at a temperature of about 20° to 100° C. for about 0.2 to 2 hours with an oil-soluble reaction product obtained by reacting about 0.5 moles of phosphorus pentasulfide at a temperature of about 50° to 180°C. for about 0.5 to 5 hours with about 2 moles of a hydroxy organic compound of the formula



where R is a hydrocarbon radical selected from the group consisting of aliphatic, cycloaliphatic, and aliphatic-aromatic hydrocarbon radicals.

Metal Spray Gun

*U. S. Patent 2,784,029, March 5, 1957.
F. Gjeller, assignor to Martin Von
Schulthess & Co.*

Apparatus for spraying metal comprising means forming a combustion chamber having an outlet, means to guide a wire into said combustion chamber, means to feed combustible material to said combustion chamber and to burn it therein so as to heat and atomize the wire and to expel the atomized wire through said outlet, a fixed hollow conical member projecting into the combustion chamber, a cylindrical member extending into the conical member and spaced therefrom, said wire guide means comprising a sleeve extending through both said members, spaced from the cylindrical member and seated in the conical member, an air passage, means connecting the end of the cylindrical member remote from the combustion chamber to the air passage, and outlets in the base of the conical member into the combustion chamber.

Solvent Emulsion Cleaners

U. S. Patent 2,787,596. April 2, 1957.
D. Stewart, assignors to Scottish Oils
Ltd.

A cleaning composition consisting essentially of the following ingredients by weight:

Percent

An alkali metal alkyl sulphate obtained by reacting a shale oil fraction boiling within the range of 180-330°C. with sulphuric acid of 90-98% strength at a temperature under 20°C. followed by a neutralization of the resulting alkyl hydrogen sulfate by treatment with an alkali metal base About 30-70

A mineral oil boiling within the range of about 150-275°C About 10-50

A high molecular weight oxygen-containing organic solvent selected from the group consisting of diethylene glycol alkyl ethers, cyclohexanol and mono- and di-methyl cyclohexanol About 1-10

An ammonium salt selected from the group consisting of ammonium carbonate and ammonium sulfate About 5-15

Water Up to about 50

Protective Coating on Chromium

U. S. Patent 2,788,292. April 9, 1957.
W. C. Giesker and R. K. Britton, assignors to The Autoyre Co., Inc.

The method of increasing the corrosion resistance of a steel article having a plating of chromium thereon which is normally cathodic to the steel of the article when immersed in a sodium chloride solution, which comprises forming a coating over the chromium plating which is anodic to the steel of the article by immersing the article in a solution containing hexavalent chromium until a coating of chromium compound is formed thereon.

Gas Plating

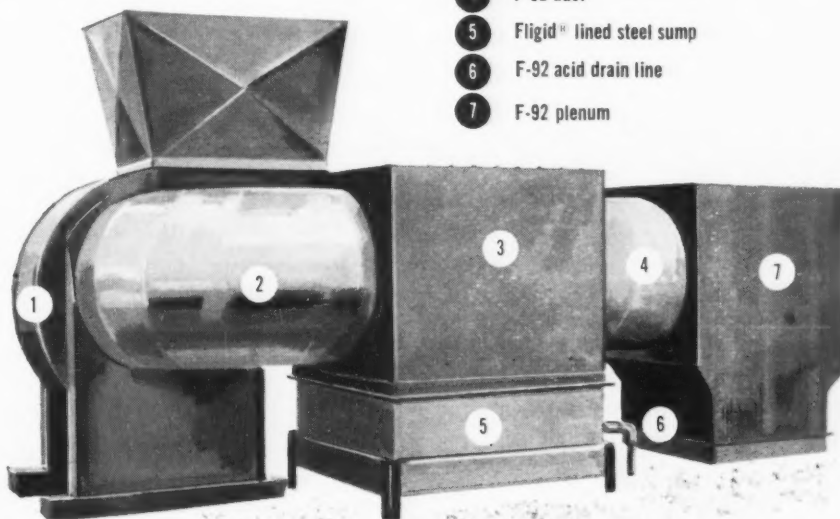
U. S. Patent 2,785,082. March 12, 1957. P. J. Clough and P. Godley 2nd, assignors to National Research Corp.

The process of coating the surface of an article with an adherent coating of a group VIa metal, said process comprising the steps of providing in intimate contact with said surface a layer

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of dry powdered carbonyl of said group VIa metal while said surface of said article is maintained at a temperature above the decomposition temperature of said carbonyl for a sufficient length of time to form said layer, the surface temperature being above the carbonyl temperature and being sufficiently low so that the carbonyl is maintained between about 130°C. and 180°C. so as to be below its melting point and solid carbonyl remains immediately adjacent the surface, said surface remaining below the temperature at which said surface can react with said carbonyl to form a volatile compound, and maintaining said carbonyl under a total pressure of about one atmosphere during the decomposition of said carbonyl, the article being maintained at a temperature which is higher than the temperature of the surrounding solid carbonyl powder during the decomposition of the carbonyl.

Hot Dip Coating

U. S. Patent 2,788,289, April 9, 1957. N. L. Deuble, assignor to Climax Molybdenum Co.

The method of forming a protective coating on a molybdenum-base alloy article which includes immersing the article in a molten bath containing aluminum and silicon at a temperature substantially above the melting point of said bath and holding said article in said bath for a period of at least 15 minutes and until diffusion between the molybdenum and the bath forms a coating at the surface of the article containing aluminum, silicon and a substantial quantity of molybdenum and having a melting point that exceeds the temperature of the bath, the silicon content of said bath ranging from about 5% to about 20% by weight and the temperature of the bath being below 2000°F.

Electrolytic Deburring

U. S. Patent 2,784,155, March 5, 1957. W. A. Heinrich, assignor to Eastman Kodak Co.

The method of removing burrs from apertures in a non-ferrous metal article which comprises making said article the anode in an electrolyte containing a saturated sodium chloride solution and 1/2 ounce per gallon of methyl cellulose, maintaining the temperature of said electrolyte at 70-75°F., providing a cathode of a non-ferrous metal, and

maintaining a current density of from 20 to 40 amperes per square foot of anode area for a period of at least 20 minutes.

Hot Dip Aluminum

U. S. Patent 2,785,084, March 12, 1957. H. Lundin, assignor to Helen Marie Lundin and Birgit Waller

The method of forming a continuous tightly adherent coating of aluminum on a base metal selected from the group consisting of cobalt, chromium, titanium, nickel, iron, and alloys thereof, which comprises thoroughly cleaning the surface of said base metal, then applying to such cleaned surface a flux comprising primarily a double fluoride of potassium and aluminum containing from 45% to 60% by weight of AlF_3 and having a melting point below 1300°F., and then contacting such surface of the base metal with molten aluminum.

Protective Coating

U. S. Patent 2,785,091, C. A. M. Rex, assignor to Jack F. Govan and Roy H. Govan

A composition of matter for use as a protective coating for oxidizable metals consisting essentially of 20% to 50% by weight sodium meta borate, 20% to 40% by weight plastic clay and 5% to 40% by weight of at least one metal oxide.

Protective Coating

U. S. Patent 2,785,097, March 12, 1957. E. W. Goodspeed and R. C. Gibson, assignors to Parker Rust Proof Co.

A composition of matter for producing an oxalate coating on a metallic surface which consists essentially of an aqueous solution containing at least 0.2% of oxalic acid and titanium in an amount greater than 0.1%.

Coloring Anodized Aluminum

U. S. Patent 2,785,098, March 12, 1957. G. L. Cunningham and M. A. Levitin, assignors to Horizons, Inc.

A method of forming a permanent colored coating on a metal substrate which is predominately aluminum which comprises forming an absorbent oxide coating on the substrate, depositing in the pores of the absorbent oxide coating a readily hydrolyzed metal-organic compound from the group consisting of metal alcoholates and metal tetraborohydrides having the

formula $\text{X}[\text{B}(\text{OR})_4]_n$ where X is a metal, R is a radical from the group consisting of methyl and ethyl radicals, and n is an integer, hydrolyzing the deposited metal-organic compound to form as one product a metal compound which is retained in the pores of the coated substrate and as a second product a readily removable non-corrosive alcohol residue, and finally sealing the treated surface by exposing said surface to the action of an aqueous medium whereby the deposited pigment is retained inside the oxide layer.

High Speed Copper Bath

U. S. Patent 2,785,117, March 12, 1957. M. Ceresa and R. E. Woehrle, assignors to Westinghouse Electric Corp.

An aqueous cyanide copper electroplating electrolyte comprising essentially from 8 to 15 ounces per gallon of copper as cyanide, at least 1 ounce per gallon of lithium hydroxide to provide a pH of at least 12, sufficient lithium cyanide to complex the copper cyanide, and from 0.5 to 2 ounces per gallon of free lithium cyanide.

Buffing Wheel Hub

U. S. Patent 2,785,516, March 19, 1957. F. E. Hendrickson, assignor to Norton Co.

A buffing wheel hub assembly for mounting buffing elements, comprising spaced end members, buffing element mounting bars between and connecting said end members, and at least one spacer support for said bars located between the end members, said spacer support engaging alternate bars, whereby a buffing element mounted on one bar extends across said spacer support engaging an adjacent bar.

Gas Plating

U. S. Patent 2,785,651, March 12, 1957. P. Pawlyk, assignor to The Commonwealth Engineering Co. of Ohio

Apparatus for gas plating continuous lengths of electrically non-conductive material by subjecting the same to a heat-decomposable gaseous metal bearing compound and heat decomposing the same while in contact with said material, said apparatus comprising an elongated enclosure said enclosure comprising a heating chamber for preheating said material and a plurality of chambers arranged in cooperating relationship therewith and through

which the preheated material is moved from said preheating chamber.

Pickling Process

U. S. Patent 2,785,999. March 19, 1957. O. Ruthner

A process for the pickling of iron and steel or alloys thereof, and for reclaiming the pickling acid, which comprises the successive steps: pickling the metal articles with a pickling medium consisting of liquid sulfuric acid and gaseous HCl in a closed pickling chamber, supersaturating the pickling liquor with HCl to precipitate FeCl_2 crystals, separating the precipitated crystals from the pickling acid, and finally heating the separated crystals to decompose them into oxide of iron and HCl.

Conversion Coating For Zinc

U. S. Patent 2,786,002. March 19, 1957. L. Van and A. Douty, assignors to American Chemical Paint Co.

The method of passivating a zinciferous surface which comprises treating it with an aqueous acidulated solution consisting essentially of hexavalent chromium, chloride and complex fluoride and water, the said ingredients per liter of solution being present according to the following formula:

Hexavalent chromium calculated as chromic acid (CrO_3)—from 20 to 90 grams.

Chloride calculated as sodium chloride—not less than 0.25 gram for each gram of hexavalent chromium (calculated as CrO_3) but not more than double the quantity of hexavalent chromium present.

Complex fluoride calculated as fluorine—not less than 0.4 gram.

said solution having a pH lying between 1.9 and 2.8 and a temperature lying between 160°F . and the length of time of the treatment being not less than 2 nor more than 10 seconds.

Burnishing Machine

U. S. Patent 2,786,308. March 26, 1957. C. C. Kinker, assignor to Gerity-Michigan Corp.

In an article burnishing machine having an elongated tank, means mounting said tank for reciprocatory movements lengthwise thereof and in substantially a horizontal plane, mounting means in the tank for an article to be burnished, means to wet said article

with a burnishing liquid, and means for imparting successive stroke movements to the tank in opposite directions; the combination of a burnishing means projecting into said tank and comprising a rotary element having a plurality of rapidly and rearwardly extending circumferentially spaced compliant burnishing mats extending into rubbing engagement with a wetted article mounted in the tank as said rotary element is rotated and the article moves past it.

Porcelain Enamel

U. S. Patent 2,786,782. March 26, 1957. H. M. Zimmerman, B. W. King and John Schultz, Jr.,

A process of producing a vitreous enameled metal body which comprises smelting a batch of enameling materials in such proportion as to yield, on calculated analysis, a frit consisting essentially of:

	Weight percent
Fe_3O_4	1-15
ZnO	0-9
SiO_2	30-45
B_2O_3	17-28
At least one material selected from the group consisting of Na_2O and K_2O	11-22
CaO	3-8
Al_2O_3	0-7

applying the resulting frit in an enameling slip to a steel body to a dry weight of from 8 to 15 grams per square foot, two sides, firing at a temperature of from 1300 to 1700°F . for a time from 3 to 8 minutes, applying a vitreous enamel cover coat, and refiring.

Fused Bath Plating

U. S. Patent 3,786,809. March 26, 1957. B. C. Raynes, assignor to Horizons Titanium Corp.

The method of cladding a base metal with a corrosion-resistant metal of the group consisting of titanium, zirconium, hafnium, vanadium, tantalum, niobium, chromium, molybdenum and tungsten by electrolysis in a fused salt bath which comprises establishing a fused salt bath consisting essentially of (a) a major amount of a halide of the group consisting of alkali metal and alkaline earth metal halides, (b) about 15 to 50% by weight of a double fluoride of an alkali metal and the corro-

sion-resistant metal and (c) about $\frac{1}{4}$ to 10% by weight of water, maintaining said bath at an elevated temperature above its melting point, and then electrolyzing the bath between a solid anode and a solid cathode composed of a base metal having a melting point substantially above the melting point of the bath.

Phosphating Compound

U. S. Patent 2,787,565. April 2, 1957. E. de Pretto, assignor to Societa Generale per la Fosfatazione S. p. A.

A liquid salt composition adapted to be diluted with water in an amount such that said composition is between 1-20% by weight of the diluted solution which is adapted to be used for the treatment of metallic surfaces, said liquid salt composition essentially consisting of at least one metallic phosphate, at least one metallic nitrate, free phosphoric acid, free nitric acid and at least one phosphoprotein, said phosphoprotein being present in an amount less than the amount of said free acids and at least in an amount of 0.3% by weight of said liquid salt composition, the total acidity of said liquid salt composition being between 3-7 times the free acidity thereof.

Cyanide Bath Purification

U. S. Patent 2,787,590. April 2, 1957. E. C. Rinker, assignor to Sel-Rex Precious Metals, Inc.

In the process of purifying an electroplating bath of the cyanide type the steps comprising, providing a complex salt of the cyanides of barium and the metal to be plated, adding the salt to the bath liquid in proportions sufficient to remove a substantial proportion of the undesired anions therefrom whereby to precipitate barium salts of said anions without adding to the free cyanide content of said bath, and separating the precipitate from the remainder of the bath.

Nitriding Stopoff

U. S. Patent 2,788,302. April 9, 1957. J. H. Dew, assignor to General Motors Corp.

The method of hardening by nitriding selected portions of a metal article which comprises coating the remaining portions of the metal article with a stopoff composition consisting of a mixture of about 30% to 75% by

volume of finely divided tin and about 25% to 70% by volume of refractory material, said refractory material consisting of a mixture of 50% to 75% by weight of kaolin, a small but effective amount of sodium silicate not over 5% by weight and the balance water, and thereafter subjecting said coated metal article to a nitriding atmosphere under elevated temperature conditions.

Anodizing Aluminum

U. S. Patent 2,788,317. April 9, 1957. C. Sonnino, assignor to Koenig and Pope

The method of electrolytically producing a flexible, corrosion-resistant protective coating on aluminum comprising anodically treating the aluminum in a bath consisting essentially of chromic acid, trivalent chromium ions and at least two compounds selected from the group consisting of tin dichromate, zinc dichromate, magnesium dichromate, aluminum dichromate, iron dichromate, beryllium dichromate, zirconium dichromate and titanium dichromate, the trivalent chromium constituting less than 5% by weight of the total chromium content of the bath and the bath being substantially free of combined and free sulfuric acid.

Chromium Plating

U. S. Patent 2,787,588. April 2, 1957. J. E. Stareck, and R. Dow, assignors to Metal & Thermit Corp.

A method of electrodepositing crack-free, chromium plate on a metal article which comprises essentially: passing current in the range of 0.5 to 8 amperes per square inch from an anode to said article as a cathode immersed in an aqueous chromium plating bath at a temperature of 140°F. to the boiling point of the bath, said bath comprising essentially 300 to 900 g./l. CrO_3 , strontium sulfate and an alkali metal silicofluoride each in an amount sufficient to saturate said bath and to provide therein an undissolved residue of strontium sulfate and alkali metal silicofluoride, respectively, and a soluble non-catalytic alkali metal compound in an amount sufficient to suppress the concentration of the alkali metal silicofluoride in solution in said bath so that the sum of the dissolved sulfate ($\text{SO}_4^{=}$) and silicofluoride ($\text{SiF}_6^{=}$) is in the range of 2.5 to 10.5 g./l., said alkali metal of the non-catalytic compound being the same as that of the alkali metal sil-

icofluoride and being selected from the group consisting of sodium and potassium, said bath being free of compounds acting to suppress the concentration of dissolved sulfate, and said sum of dissolved sulfate and silicofluoride varying with the CrO_3 concentration in the manner defined by the area ABCD of the graph shown in the accompanying drawing.

Strip Metal Degreaser

U. S. Patent 2,788,540. April 16, 1957. L. W. Snape, assignor to The Gillette Co.

Apparatus for degreasing ribbon steel, comprising an inner closed housing having inlet and outlet slots in opposite walls for the passage of the ribbon, and outer casing enclosing the housing and insulated by air therefrom, rolls mounted inside the casing and outside the housing for feeding the ribbon through the housing, means for directing a blast of steam at 55 to 100 lbs. gauge pressure at the ribbon within the housing, and means for maintaining a partial vacuum in the housing to increase the velocity of the steam blast and remove spent steam from about the ribbon.

Phosphate Coating

U. S. Patent 2,789,070. April 16, 1957. H. B. Copelin, assignor to E. I. du Pont de Nemours & Co.

A uniform substantially water-free composition of matter suitable for phosphatizing metals consisting essentially of a chlorohydrocarbon degreasing solvent containing between about 1 and 10% by weight of an acid alkyl phosphate in which the alkyl radical contains between about 6 and 18 carbon atoms and an effective phosphatizing quantity of orthophosphoric acid.

Balanced Rotary Brush

U. S. Patent 2,789,302. April 23, 1957. A. T. Schofield, assignor to The Osborn Mfg. Co.

An annular rotary brush section comprising an annular sheet metal continuous channel back opening radially outwardly, an annular retaining element within said channel, and brush material secured beneath said retaining element in said channel and extending generally radially therefrom in a substantially uninterrupted layer.

Plating Machine

U. S. Patent 2,789,569. April 23, 1957. J. V. Davis, assignor to The Udylyte Corp.

In combination, a liquid treating station adapted to receive work carried on a plurality of work carriers, stationary means for supporting the work carriers at said station in lower, horizontally fixed positions, a frame forming a part of said station, a plurality of pairs of opposed movable track sections carried by said frame, driving means for repetitively moving said frame and the pairs of movable track sections carried thereby between an upper position and a level proximate work carriers supported at said lower positions by said stationary means, means for selectively moving each pair of said movable track sections when said frame is proximate work carriers supported at said lower position between a retracted position and a position in which it will engage a work carrier supported at said lower position by said stationary means whereby a selected carrier may be lifted upon movement of the frame to its upper position, and means including said selected pair of track sections forming when the frame is in its upper position a continuous track on which carriers may be conveyed over others of the work carriers that are then supported on said stationary means.

Fused Bath Cleaning Pot

U. S. Patent 2,789,807. April 23, 1957. J. A. Faler, assignor to Kolene Corp.

A pot for use as a dipping bath comprising an inner shell for containing a molten bath material and surrounded by an outer shell having walls spaced from the walls of the inner shell and the walls of the inner shell serving as a common wall between the outer and the inner shells; said outer shell being provided with heating means for transferring heat into the inner shell, electrical means for removing the scale formed on the side of the common wall located within the outer shell, said electrical means comprising at least one anode inserted in the outer shell and a D. C. electrical power source electrically connected to the anode and also to the wall of the inner shell wherein the anode is positive and the inner walls are negative.

ABSTRACTS

Polishing of Aluminum and Its Alloys

H. Ginsberg and F. Baumann: *Metall.* Vol. 8, Nos. 5-6, p. 206.

The authors discuss the formation of oxide coatings on aluminum and alloys and state that, although considerable research has been performed on the subject, no really satisfactory fundamental data have been obtained. It is known that the protective coating is not of uniform structure through its thickness. When a voltage is applied to an anodized aluminum sheet, the chief voltage drop occurs in the proximity of the metal surface. This would lead one to suspect that, during oxidation, a ground coating grows directly onto the metal, which imposes a high resistance to the current for which reason it is often designated as a dielectric coating. It has been found that the thickness of this coating amounts to about 14 Å per volt. In electrolytes which have a notable solvent power for the coating, a much thicker porous coating forms on this ground coating which offers a lower resistance to the electric current. In strongly solvent electrolytes, where the solution of the coating proceeds as rapidly as its formation, then a smoothing of the surface roughness occurs.

When oxide coatings are applied on a previously polished aluminum surface it would be expected that the mirror reflection would suffer deterioration. Up to now, it has been assumed that the decrease in reflective capacity is proportionate to the coating thickness. Tests have shown however, that it is only during the first few minutes that this happens; lowering of the reflective capacity by the subsequent oxide coating is then relatively low, particularly with coatings on high purity aluminum.

Chemical polishing of aluminum is assuming increasing importance in recent times. Although, at first sight, it does not seem to have much in common with the anodic process, precise investigations show that it rests on the same fundamental processes. Reflection tests which were conducted on pure aluminum sheet in the Erftwerk polish-

ing bath showed that no smoothing of the surface took place immediately, but that a pickling effect occurred during the first seconds of immersion, by virtue of which the mirror reflective characteristic dropped practically to zero. It is only then that the true polishing action commences and which is ended after about 15 seconds. After this, the specular reflection remains fairly constant. The polishing procedure is greatly influenced by the various alloying constituents of the aluminum. Thus, for example, small iron contents (above 0.02% Fe) considerably reduce the outstanding polishing effect obtained with pure aluminum with the EW process and, with iron contents of more than 0.1%, it is not possible to get a polish effect with the Erftwerk process. However, other polishing processes are not so sensitive to the presence of other metals. Thus, with the VLW polishing bath (Vereinigten Leichtmetall-Werken) it was found on test that reflective values, up to an iron content of about 0.1% Fe, are hardly any worse than those produced with the purest aluminum and fall off only slowly with higher iron contents.

It was found that, with the choice of a suitable electrolyte as well as with the prior choice of a suitable polishing bath, the influence of the iron content or similar impurities in the aluminum metal can be suppressed.

Mechanism of Periodic Current Reverse Plating Cycle

J. Elze: *Metall.* Vol. 8, Nos. 17/18, p. 699.

Two of the principal advantages obtained with periodic current reverse plating are the possibilities of applying higher current densities and the further possibility of using a thinner coating, as the plate from this cycle, generally speaking, is less porous and more compact and offers a better corrosion resistance. The net result of these two factors is a higher throughput for a given size installation. In spite of the considerable and extended use which has been made in practice, particularly with copper from cyanide baths, very little fundamental research on the actual phenomena has been performed and very little real fundamental knowledge on the matter is actually available at the moment. The first real fundamental work was accomplished

by the German researchers Fischer and Dosch. These workers selected for the investigation an electrolyte which was used for the polishing of silver (high carbonate content) and which is scarcely able to give commercial coatings in normal plating.

The most interesting and useful section of this work concerned the investigation of deposition-polarization and particularly with polarization phenomena during the time in which the object is anodic. The bath used was: Silver 48 g./l.; potassium cyanide 9 g./l.; potassium carbonate 68 g./l. The current reversal ratio was 12:1. Three polarization stages were clearly seen which were indicated as follows:

1. Normal anodic solution of the silver;
2. Impoverishment in cyanide ions and formation of silver cyanide in the immediate neighborhood of the cathode;
3. Formation of silver oxide by which it was noticed that there was no visible oxygen generation even with relatively high current densities.

If the anodic loading is continued for a longer time, there sets in strong polarization fluctuations, already known from anodic silver polishing practice. All the findings indicate that there is an oxide occurrence at the electrode during the reverse stage and this would appear to be an absolutely necessary phenomenon for the results obtained with the P.R. process. Apparently, it is not only a film of metal oxide which is necessary for the plating mechanism desired. Other films may be able to exert the same effect. It is considered by the author that, without such a film, no polishing action is possible. The film prevents orderly crystal structure formation and leads, at the anode stage, to a solution of the metal particles in a statistical distribution and not in a preferred order, as would be the case if crystal structure were present.

The fact is also of fundamental significance that investigation of the cross-section of the deposit with P.R. shows nothing but, on the other hand, microscopic surface examination of the coatings clearly shows the actions of the periodic reverse.

Study of the curves of the deposition voltage in relation to coating thickness shows that the current reverse time ratio has a considerably stronger in-

fluence on the electrode action than the period duration has. It cannot yet be clarified whether the concentration changes, which occur in the cathode film due to the P. R., take part in the effect achieved.

Electropolishing of Metals

P. A. Jacquet: *Metall.* Vol. 8, Nos. 11/12, p. 449.

The author considers electropolishing techniques from the aspect of the physical characteristics, both with the starting metal and its initial treatments, up to the finished, electropolished surface and the applications of these surfaces, according to the variations in the surface physical characteristics obtained.

Regarding the physical characteristics of an electropolished surface, individual unevennesses of the microstructure are to be ascribed to varying structural constituents (phases) which may be present at any given point. As a heterogeneous surface structure in commercial metals is always encountered, the best electropolishing process to adopt for any given case is that which will reduce the varying anodic solution speeds of the constituents to a minimum. The quality of a mechanically polished surface likewise depends on the microstructure. It is, accordingly, the hardness differences of the various phases, which condition the characteristics of the microstructure.

If the physical characteristics of an electropolished surface are considered, it will be seen that electropolishing cause no disturbance in the crystal structure. If disturbances of this nature are already present, for example as a result of mechanical working of the surface, the zones concerned are completely removed with sufficiently long electrolysis.

In order to obtain, by electropolishing, a surface which is completely free from the anomalous layers caused by a mechanical pretreatment, such as crystal twinning for example, the following needs to be observed. The thickness of the disturbed zones vary considerably with the nature of the metal or alloy and the surface working conditions. In general, this thickness grows with the crystal size. To determine the polishing time required, it is necessary to have available a sufficiently sensitive test method. For this

purpose the penetration depth with X-rays is too great. Electron bending concerns only very small depths (some 10Å).

Temperature control is also a pressing necessity. In the laboratory; operations are conducted at room temperature. However, particularly with large scale work, some polishing electrolytes heat up considerably at the anode, especially with solutions with a low electrical conductivity, and this heating effect is further favored by an increased current density. Thus, during electropolishing, there has been measured at the surface of a small aluminum sheet (acetic acid-perchloric acid electrolyte) which was kept in motion, a temperature of 60° to 70° C., the temperature in the body of the electrolyte being 20°C. Such heating-up can cause certain changes in the mechanically disturbed surface coatings and even in the sub-surface.

Apart from oxide formation on the polished surface during or after the polishing, the compounds contained in the viscous anode coating may also contaminate the surface, if they cannot be removed by washing. By microchemical methods, traces of phosphorus compounds have been detected on copper, zinc, and magnesium polished in phosphoric acid electrolytes. This contamination, however, does not seem to be serious. All electropolished surfaces are characterized by a high chemical activity, particularly to oxidizing media.

Plating Research and Practice: More Uniform Deposits

By H. Fischer: *Metall.* Vol. 8, Nos. 11/12, p. 435.

When deposits obtained under laboratory and large-scale operational conditions are investigated, a striking feature is the great deviation in chemical and physical characteristics.

Uniformity in the composition of the plated metal comprises a constancy in the content of the chief constituents, particularly in the foreign body content (whether accidental or intentional), for example hydrogen, oxide, foreign metal, organic inhibitors, residues of electrolyte, etc. If the metal is deposited uniformly then neither in the lattice and sub-structures nor in the crystal structure should the deposits deviate to any considerable extent from one another. They should

not differ also in the number and size of the pores, in the local and average thickness of the deposit, etc.

It may be considered that such requirements are unobtainable and this holds good, with still more emphasis, if it is desired to employ a higher current density. However the multiple influencing factors concerned with the creation of the deposit are determined by a relatively limited number of definable deposition conditions: current density, voltage, temperature, electrolyte movement, and composition. This is apart from the nature and characteristics of the metal object being plated.

It is only in very few cases that the composition of the bath can be held constant over any prolonged period under practical conditions. Even with so simple an electrolyte as an acid copper sulfate bath, with progressive electrolysis noticeable changes in the bath occur. Research in recent years has shown that these changes are not based solely on the relationships of cupric and cuprous ions in the electrolyte. It would also appear that sulfate ions are also reduced—even if in small amount. In this way there is apparently formed a trace of colloidal copper sulfide, which is capable of acting as an inhibitor even in very small amount and which can structurally change the deposit. There are certainly many such phenomena of this nature in plating practice. Further, an explanation is still waiting for them. These phenomena are obviously also concerned with what the practical man terms "working-in" or "aging" a plating bath.

The position becomes much more complicated and difficult to control, if an effective organic brightener is added to the bath. These addition agents, in very low concentration, are able to act on the deposition potential and on the characteristics of the deposit. This influence is generally strengthened with increased concentration. During the course of electrolysis, the concentration of the addition is often noticeably reduced, first by depositing continually on the cathode and secondly, by cathodic reduction or anodic oxidation. In the two latter cases, reaction products are formed which often again inhibit, but with a changed action.

Co-separation of hydrogen further serves to worsen the possibility of uniform deposition. The phenomenon of secondary inhibition is often associated with this hydrogen deposition and

the cathode film is also subjected to disturbances.

Chemical Polishing Baths for Aluminum and Its Alloys

By H. Spaehn: *MetallOberflaeche*. Vol. 6, No. 2, B 17.

Numerous chemical polishing baths are known for the aluminum metals, most of which are covered by patent and these can be broadly classified into two groups:

1. Highly alkaline electrolytes.
2. Acid electrolytes whose principal constituents are phosphoric acid and nitric acid.

As an example of the class I bath, there can be instanced the Alupol Bath I composition, which is: caustic soda 300-600 g.; sodium phosphate 100-300 g.; sodium nitrate 300-500 g.; sodium nitrite 200-300 g.; water 100-300 g. The bath is worked at 140°C. in iron tanks. The dip time is short, about 2 minutes. The polish obtained is not good and the bath serves as a predip for an acid polishing bath.

The acid polishing baths are the ones most extensively used and there are many variations. Sometimes, acetic acid or sulfuric acid are used in conjunction with the phosphoric and nitric acids.

The German Erftwerk bath is characterized by differing from the above baths. A feature of this bath is the high water content, the bath composition being 13% by weight of nitric acid and 16% by weight of ammonium bifluoride.

The achievement of a polish by a chemical bath depends not only on the bath composition but also on the correct selection of the metal. Aluminum alloys containing zinc and copper give an unsatisfactory polish and are also difficult to anodize. Alloys with a high silicon content are also quite unsuitable for chemical polishing but, on the other hand, the Al-Mg-Si alloys are suitable if they have had a suitable heat treatment. Best results are obtained with pure aluminum. The question of the degree of purity appears to be somewhat critical, as tests have shown that a normal commercial pure aluminum (99.7%) offers greater difficulty in chemical polishing than does a 99.99% pure aluminum. It has been found that the chemical polishing baths best suited for this type of aluminum are the nitric-phosphoric-acetic

acid type, the treatment temperature being about 100°C. The texture of the alloy also influences the polish to a noticeable extent. This is the reason why, with some alloys, better results are achieved after a heat treatment.

Venting and Fume Exhausting Plating Baths

By E. Stocker: *Metall*. Vol. 8, Nos. 11/12, p. 468.

Not only poisonous or strongly acid fumes need removing from the plating room, but many plating baths work with production of gassing which gives rise to a fine mist in the air, containing chemicals from the bath. These, inhaled continuously over long periods can be most serious to health.

Normal water vapor or similar non-aggressive vapors can be exhausted by normal exhaust suction equipment constructed of steel sheet. Vapors which are of an acid or reactive character, according to their nature and characteristics, must be exhausted by venting layouts consisting of corrosion-resistant materials or steel-sheet lined with suitable materials of this nature. The design and dimensioning of the exhausting unit parts is by far best left to the contractor installing the equipment, who will have adequate figures and practical experience available concerning the width of the suction opening over the bath, the duct diameter and the size of the fan.

The ducts should be kept as short as possible but the ejecting duct into the open air should be so designed that expulsion into the air occurs at a height and there is no danger of contamination of the immediate surroundings. The ejection point of the fumes from the exhausting system into the air should be at least 40 ft. from the nearest window and at least about 6 ft. above the nearest roof.

In the design and installation of the system, care should be taken that the ducts are smooth internally and without obstructions and are so dimensioned that adequate and correct relationships exist for the air entry flow; sharp bends, abrupt change of flow direction, and constrictions should be avoided as far as possible. The ejection ducts expelling the fumes into the open should pass straight upwards through the roof as an ideal arrangement. To make the layout look attractive, quite often the ducts are led

away at floor level, then through the wall and up and along the roof. Thus, a fall and then a rise in travel which is not good practice. In a large plating installation it is best to have a number of expulsion points rather than to concentrate the fume expulsion at one point by merging a number of ducts into one.

Thermal Chromizing

By P. Galmiche: *Galvano* (Paris). Vol. 24, No. 221, p. 27.

The characteristics of diffusion coatings of chromium (chromizing) are as follows. The thick surface chromizing of low carbon or decarburized steels gives rise to the formation of very uniform diffusion coatings whose composition varies progressively from the surface. At the surface zone the coating can attain, according to the treatment conditions, 35 to 60% chromium: these coatings are ductile and their hardness is a little above that of the basis metal.

The coatings of chromium carbide obtained on carbon steels treated under conditions permitting avoidance of decarburization are much thinner for equivalent conditions of treatment but extremely hard (1,000 to 1,600 Vickers). They have a clear matt gray appearance and their ductility is lower than that of coatings of bright chromium.

In the B.D.S. and D.A.L. chromizing processes, the chromium is provided mainly by exchange reaction: in the French Onera process, the chromium is provided without elimination of iron; the treatments give an appreciable build-up which is however very uniform (the over-thickness is about one third of the useful thickness of the coating. It may be necessary to under-dimension the parts to allow for this. The problem of distortion, due mainly to the internal stresses previously existing in the parts, is in general very limited. The quality of the steel, i.e. its homogeneity, is an essential factor for certain applications. For corrosion protection, even very thick chromized coatings can protect only imperfectly steels which have coarse and large inclusions.

Protection against nitric acid is easily obtained with low carbon or decarburized steels. The coatings also provide protection against high temperature service and against wear.

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES



Automatic Unloader

Wagner Bros., Inc., Dept. MF, Detroit, Mich.



Working something like a "see-saw", with its arms making a 120-degree arc in rocking back and forth, a new unloader, especially designed for an automated plating machine, automatically unloads plated parts.

The unit, which is said to perform work normally requiring two men, grasps and removes a rack-load of parts as they come from the plater's drying station, tilts the load forward to deposit plated parts onto a moving conveyor belt. The rack is then returned to the machine for its trip to the loading station via the stripping and rinse baths.

The unit can be synchronized with any preset cycle of the automatic plater. As a package unit, it can be adapted to most automatic plating equipment now in use, say company engineers.

63/Circle on Readers' Service Card

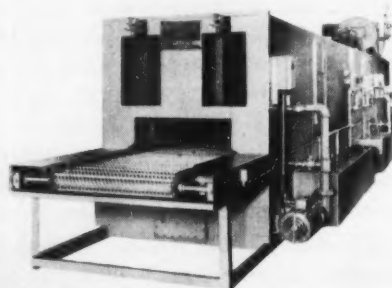
Washing Machine

The Alvey-Ferguson Co., Dept. MF, 1966 Disney St., Cincinnati 9, Ohio

The new automatic washing machine provides for all cleaning operations in one central area and virtually elimin-

ates rehandling of parts following cleaning operations. Because it performs the work of three separate washers in a single housing, this new "Triple Tunnel" type machine also saves floor space and reduces operating and maintenance costs.

Two overhead conveyors and flat wire mesh belt conveyor pass through the machine, which incorporates an automatically-timed wash-rinse-dry cycle. In operation, parts are placed on the appropriate overhead conveyor according to subsequent operations to be performed on them. For example, while one overhead conveyor is carrying parts to sub-assembly from the washer, the other trolley conveyor is taking parts through painting and drying operations. The flat wire mesh belt con-



veyor handles parts, including machined parts, which cannot be effectively cleaned and dried when suspended from an overhead conveyor, as well as parts routed to other destinations, such as storage. The three conveyors may be operated either simultaneously or individually as required.

First cost as well as operating costs of this new machine are reduced by the use of common solution tanks and spray system for all three conveyor lines as well as common headers for water lines and drains which require only single connections.

This new machine is durably constructed for long, trouble-free service life. Provision has been made for easy access to spray areas and solution tanks to facilitate inspection and maintenance.

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Immersion Gold Process

Baker & Co., Inc., Dept. MF, 113 Astor St., Newark 2, N. J.

On the basis of extensive production-line tests by manufacturers of trophies and jewelry, a new non-electrolytic 24-carat gold plating process is claimed to have major advantages over electroplating.

1. The coating is denser, so that the same appearance can be achieved with 35 per cent less gold.

2. Since there can be no electrical shielding, there are no low-or high-density areas—all parts of the object, even blind recesses and the inside of tubing, receive a uniform deposit.

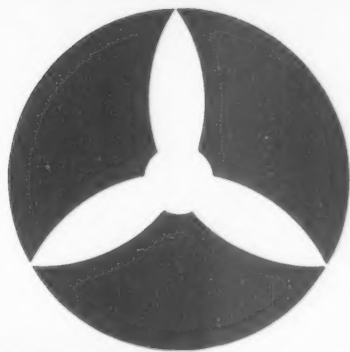
3. The gold actually interlocks with the basis metal, providing a much firmer bond.

4. Analytical control of the bath is unnecessary because there is no free cyanide or carbonate buildup.

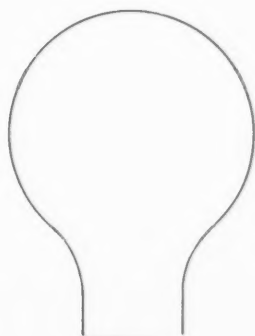
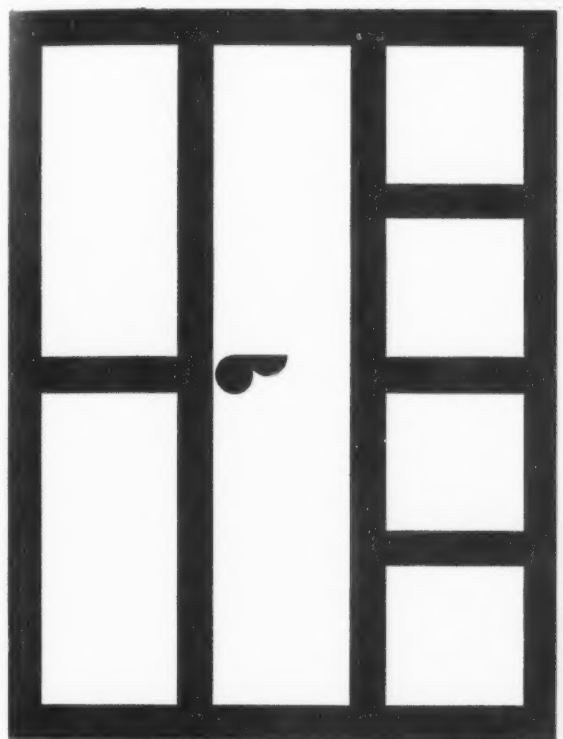
5. All the gold in the bath can be used up. The spent solution is thrown away, rather than sent back to the manufacturer for refining.

The process has been tested successfully on copper and copper-base alloys, cadmium, zinc, nickel, iron, Woods metal, nickel-silver 12%, type metal, steel, die-cast alloys, soft solder, pew-



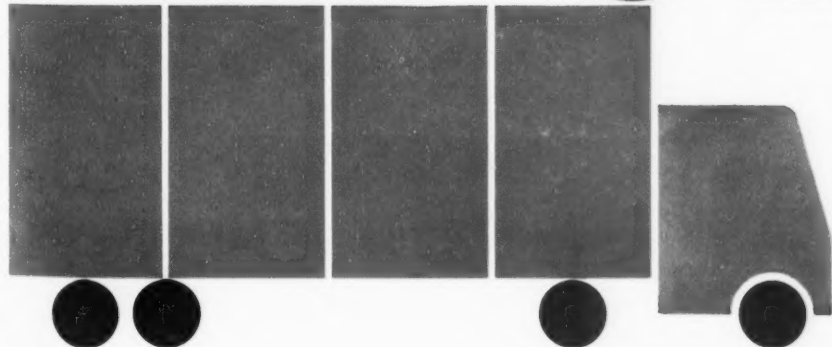


C I B A



For Aluminum

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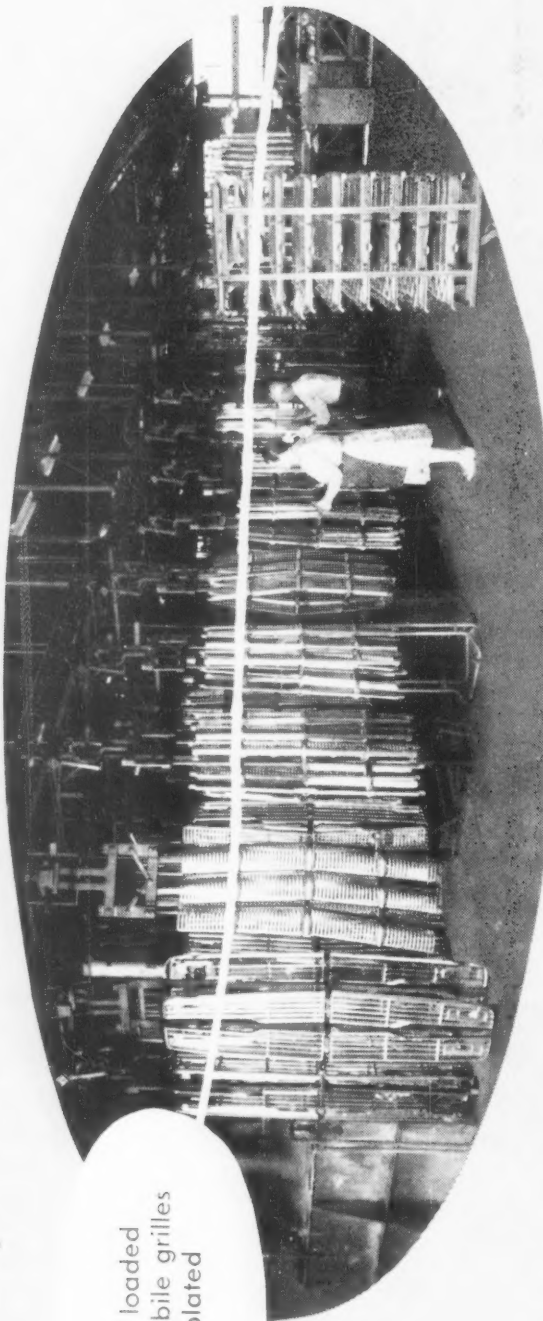
The story of aluminum is a classic in metallurgy. Now put to infinite uses, from foil wrappings to skyscraper panels, aluminum has inevitably and naturally turned to color. Through surface anodizing aluminum is dyed in practically all colors with inherent beauty and fastness. Outstanding for this purpose are the OXANAL FAST dyes of CIBA. Backed by CIBA's vast experience with dyes, they offer the best assurance of fine aluminum dyeing.

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CIBA Company Inc., 627 Greenwich Street, New York 14, N. Y.

Every 57 Seconds

A rack is loaded
with automobile grilles
to be plated



The Udylite Plating Machine at the Jackson, Michigan plant of Ryerson & Haynes, Inc., is fully automatic with automatic rack handling as an integral part of the machine.

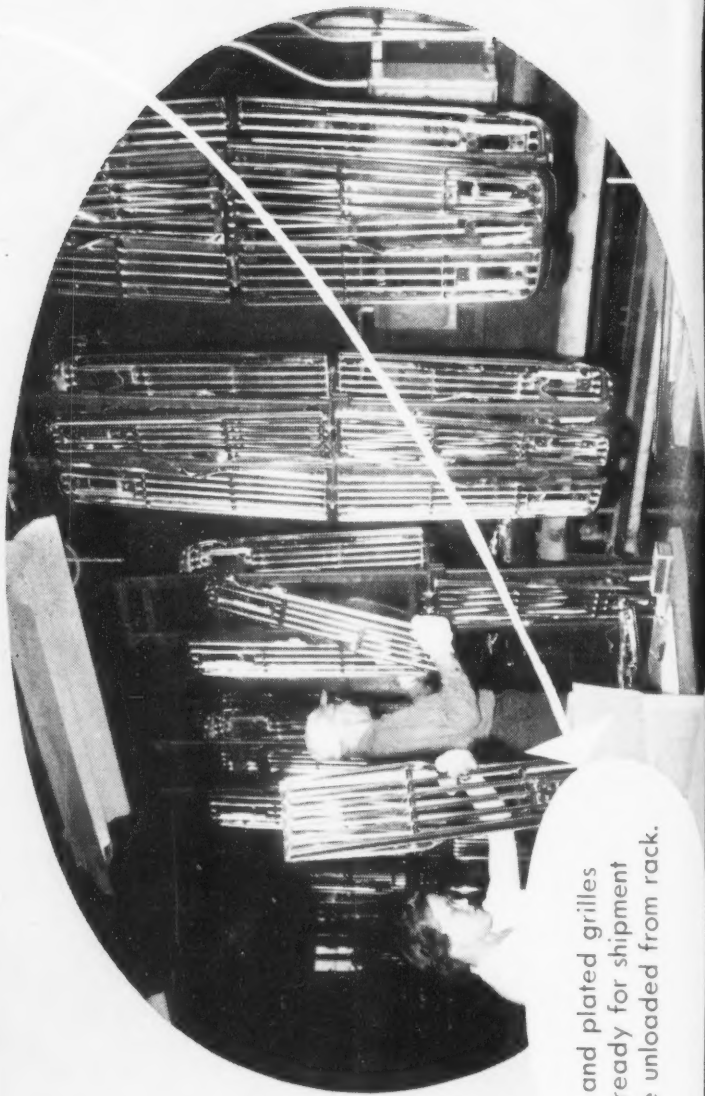
The racks, loaded with grilles to be plated, automatically move from the plant conveyor to the Udylite machine to start the twenty step cycle of precision nickel and chrome plating.

Then, after the processing cycle is completed, racks of plated grilles move automatically from the Udylite Plating Machine onto the plant conveyor and into the packaging and shipping department.

With automatic rack handling, chance of damage and human error are reduced to a seemingly impossible minimum. This is particularly important after nickel-chrome plating, when the grilles carry an investment of plating time and materials.

Ryerson & Haynes, Inc. have enjoyed the benefits of this Udylite machine since January of 1955. Production has been constant, two or three shifts a day, five to seven days a week.

You, too, can lower costs and reduce rejects with Udylite production plating and automatic handling equipment. Write us today.



and plated grilles
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ter. Alumel, cobalt, and bismuth alloys. It undoubtedly can be used on a number of other alloys not tested, according to the manufacturer, and coatings up to 10 millionths thick can be applied to most metals.

The "Atomex" bath is prepared by simply mixing a 200cc unit of concentrate, containing 1/2 troy oz. of fine gold, into a gallon of water. Any tank which will resist slightly acid or alkaline solutions can be used, including Tygon, Koroseal, polyvinyl, glass, or plain uncoated stainless steel.

The rate of deposition varies with the type of metal being plated and the temperature. For example, it takes about three minutes at 60°C to deposit 1. mg./in.² on iron, die-cast metals, steel, or soft solder. At 90°C, it takes one-and-a-half minutes. In the case of copper and certain special alloys, the bath's pH must be controlled by adding small amounts of ammonia as necessary.

In general, objects to be plated are cleaned as if for electroplating. In the case of copper-printed circuit boards, however, it has been found that scrubbing with wet pumice or proprietary cleansing powders is better than chemical cleaning.

A patent is pending on the process.
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Plating Racks

Automotive Rubber Co., Inc., Plating Equip. Div., Dept. MF, 12550 Beech Road, Detroit 39, Mich.

In a recent introductory move, the Plating Equipment Division of ARco, (Automotive Rubber Company, Inc.), Detroit, Michigan, announced the development of a new, unique type plating rack. These racks, after a broad survey and 18 months of research and development by ARco engineers, reportedly answer the rack demands of industry.

Versatility, simplicity, durability, and long life have been incorporated into the basic design of this new type rack, helping the user to reduce metal build-up on racks, drag-out losses, drag-in solution contamination, high maintenance, and product rejects.

The design of the unit provides direct current conduction from the hook to the piece-holding member without resistance joints. All rubber-to-rubber joints of the assembled rack are sealed with two ribs, one concentric to the other.

The splines and other components of

**Now...
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plating solution filter...**

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Zinc Cyanide
Acid Copper Sulphate
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Sparkler plating filters are used in some of the largest plating plants in the world.

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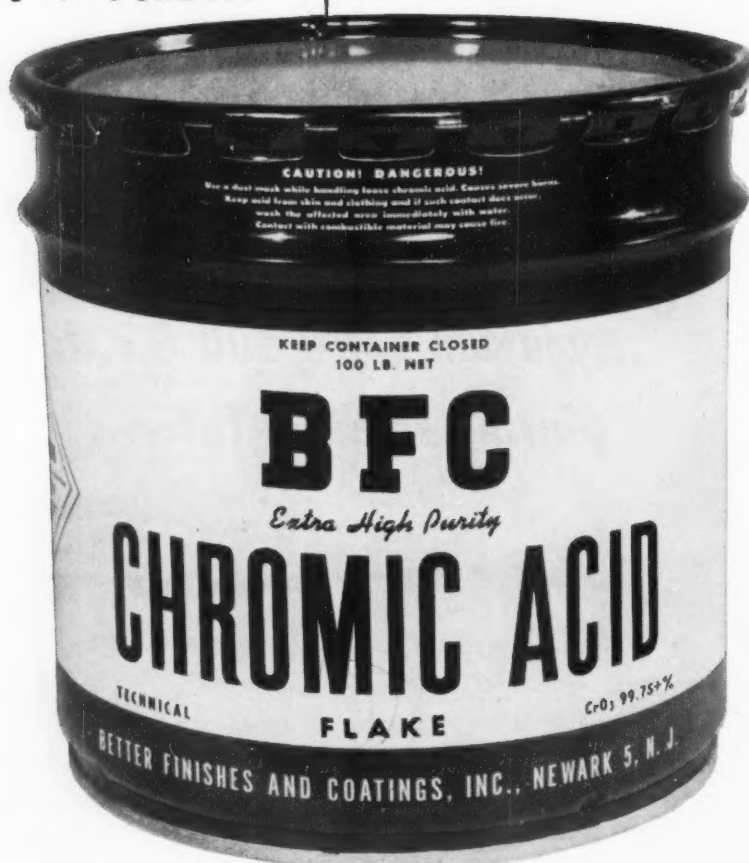
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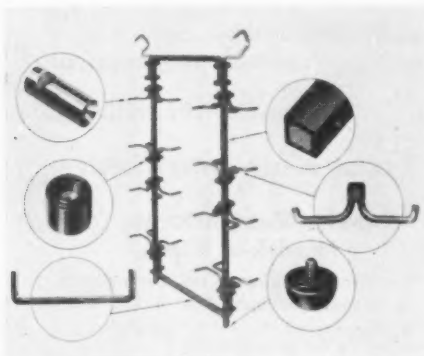
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2014 East 15th Street,
Los Angeles 21, California

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this new unit are completely covered prior to the assembly with a newly developed, molded thermosetting compound. These splines and components incorporate self-sealing joints and are assembled to form a rack to meet



user's specific requirements. The elastomeric coverings have been developed in the firm's laboratories and produced in their own rubber mill specifically for plating processes.

Holding members, designed for the pieces being plated, are fabricated from spring rod or flat stock to allow the use of removable contact tips. The spring member is positively located with a stud and can be readily replaced if necessary. Holding members are completely protected with a molded coating except for the contact tips and two circular faces on the body. One of these exposed faces extends into the spot-faced area of the spline for electrical contact. The other face is that

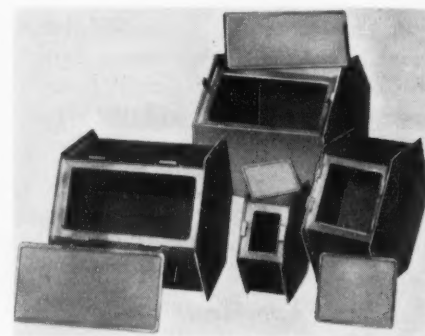
surface to which a retainer nut of the stud is tightened. This nut is covered with a rubber ribbed sealer cap.

Because of the simplicity of design and versatility, the manufacturer points out that only a small inventory of parts need be stocked to keep all racks in operation with full production capacity at all times. The self-sealing assembly and disassembly factors reduce repair down-time to a matter of minutes and repair costs to a minimum. Also, at model change-over time, only newly designed holding members for new parts to be plated are necessary. New openings may be machined into the spline and abandoned openings covered with sealer plugs.

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Lined Tumbling Barrels

Rampe Mfg. Co., Dept. MF, 14915
Woodworth Ave., Cleveland 10, Ohio



Visibility, ease of cleaning and long wearing qualities are improved with these orange-colored vinyl plastic lined tumbling barrels. The resilient linings feature a special "No-Seam" application and provide a smooth, light-reflecting surface for cleaning and inspection. Available on all Rampe tumbling barrels for new equipment or replacement, the orange linings replace earlier black plastic linings. They are highly resistant to wear and abrasion, oils and most chemicals.

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Alkaline Deruster

Heatbath Corp., Dept. MF, Springfield, 1, Mass.

A new derusting compound, Derustal, is an alkaline material for use in removing rust, scale, paint, enamel, lacquer, and oil from ferrous metal without any attack on the basis metal. The material can be used to replace acid pickling operations, thus eliminating the hazards of pitting the parts to

be cleaned and eliminating hydrogen embrittlement of high carbon steel and spring parts.

The product is a free flowing powder and is used 1 to 3 pounds per gallon of water at a temperature of 180°F. to boiling. Time of immersion will be from a few minutes to a half hour, depending upon the amount and kind of rust, scale, paint to be removed. Only mild steel equipment is required for operation of the solution.

70/ Circle on Readers' Service Card

Rhodium Plating Solution

General Plate Div., Metals & Controls Corp., Dept. MF, Attleboro, Mass.

General Plate rhodium plating solution offers exceptional packaging advantages. Unbreakable transparent containers can be safely handled and stored. A scale on every container



ensures accurate and economical measuring of the liquid content. In addition, the company is equipped to refine residual solutions that are returned by electroplating firms when their solutions become contaminated. The refinery will also reclaim rhodium from plating racks, wires, etc.

71/ Circle on Readers' Service Card

Solvent For Use With Ultrasonics

London Chemical Co., Inc., Dept. MF, 1535 N. 31st Ave., Melrose Park, Ill.

A new industrial solvent for use with ultrasonic cleaning equipment offers selective solvency, electrical stability, rapid drying, safety and low unit cost. Sonic-Solve #113 has the power to remove contaminants without affecting plastics, decals, numbers, magnet wire, insulating varnishes, etc. The non-ionic, non-hydroscopic liquid is completely stable and safe for use with electronic cleaning equipment. After 10 seconds in an ultrasonic cleaner using the sol-

vent, completely assembled open relays are devoid of rosin fluxes, oils, greases and dirt, it is claimed. Another five minutes in an ultrasonic dryer and the parts are ready for packing. The product also dries rapidly in open air. No rinsing or neutralizing is necessary. It is non-flammable and has a minimum toxicity of 500 ppm. in air in an eight-hour working day.

73/ Circle on Readers' Service Card

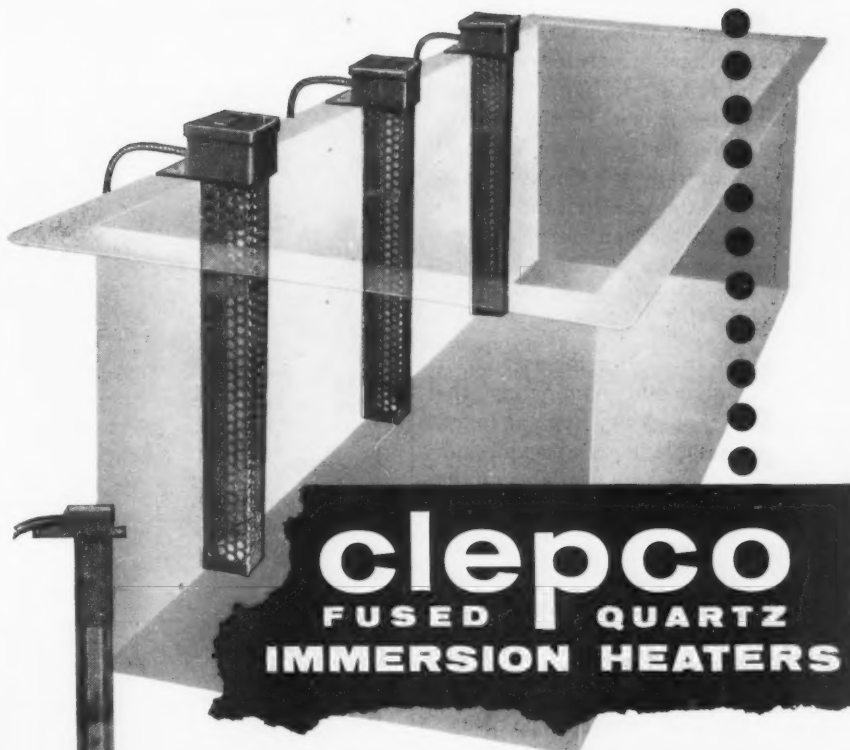
Flanges For Coated Abrasive Wheels

Minnesota Mining and Mfg. Co., Dept. MF, 900 Bush St., St. Paul 6, Minn.

Disposable flanges and a design that

permits flush sanding are two major improvements in the manufacturer's line of small coated abrasive "PG" (polishing and grinding) wheels for finishing and maintenance operations.

The new disposable flanges, which



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OVER 100,000 INSTALLATIONS

For alkaline or acid heating jobs, you can depend on CLEPCO ELECTRIC IMMERSION HEATERS

CLEPCO STEEL and STAINLESS HEATERS will meet all your specific needs.

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72/ Circle on Readers' Service Card

lock the wheel's coated abrasive leaves securely in place, are factory-installed and bonded to the core. This construction technique makes it unnecessary to remove the flanges when a wheel change is required; it's simply a matter of slipping the wheel on the spindle and tightening the cap nut. Performance characteristics of the wheel remain unchanged; and prices are not affected by the improved design.

In addition to offering the user faster wheel changes, and eliminating the necessity for stocking extra flanges, the new disposable flanges provide hub strength not previously available on the small wheels.

Another feature of the newly-designed wheels is that the flanges are recessed into the side of the wheel. The end cap nut is also recessed, so that the wheel can be used flush against a surface, as in finishing a right angle or corner. The new recessed-type flange also allows the wheels to be ganged more closely to obtain a wider abrasive surface. The recessed flanges are available on all diameters of the small (6" through 10" dia.) wheel line, and on widths 1½" and up.

Specifications for the new flanges include a standard 1" center hole on wheels 6" in diameter; and a standard 1¾" center hole on wheels with a 7", 8", 9" or 10" diameter. Wheels 11" and larger — known as standard or large "PG" wheels — will continue to use changeable aluminum flanges.

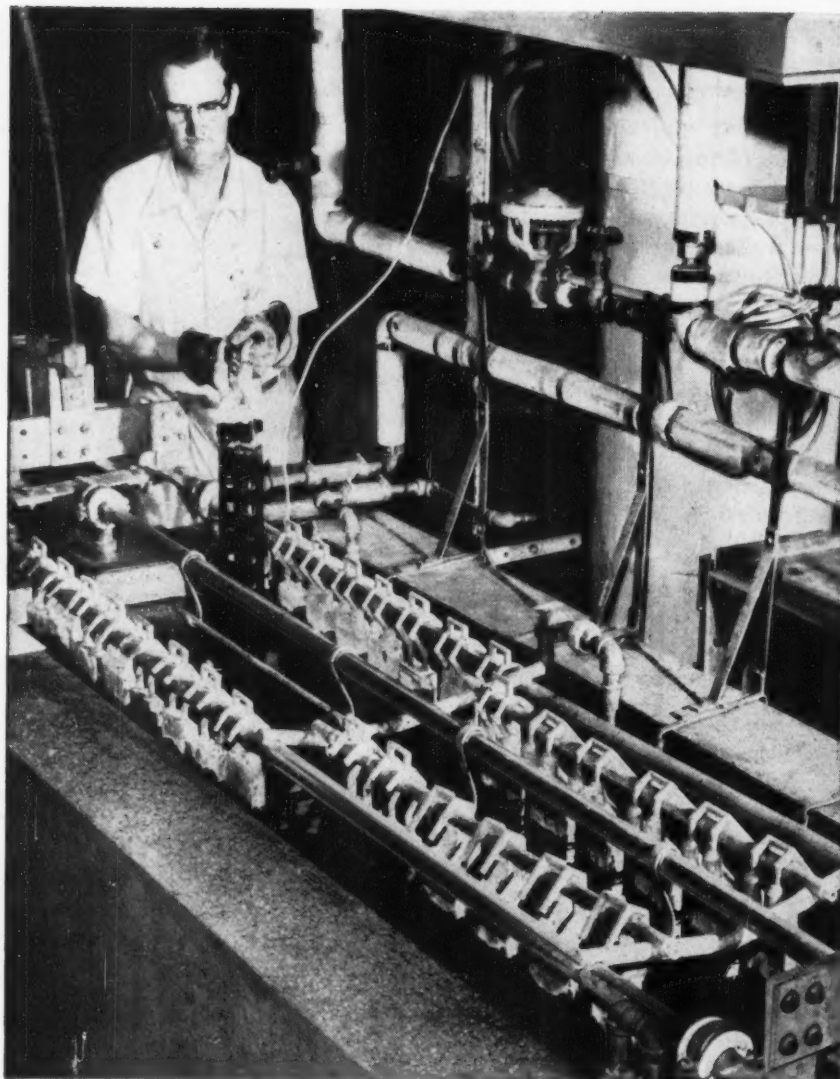
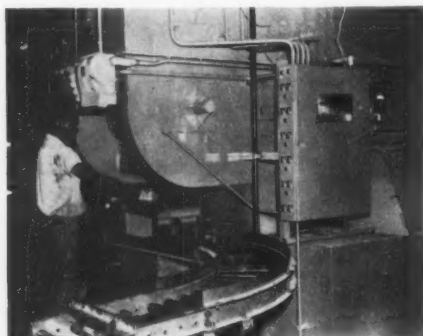
Three new adapter kits designed for use with the disposable flange-type wheels make it possible to fit the wheels onto any portable tool or bench lathe.

74/Circle on Readers' Service Card

Screw Parts Washer

*Industrial Systems Co., Dept. MF,
Matawan 1, N. J.*

A new type washing machine designated the Roto-Jet, automatically



FEDERATED PRODUCTS FOR THE PLATING SHOP

ANODES:

Copper anodes in all shapes and forms; lead anodes, including the famous Conducta-Core; zinc anodes, tin anodes, tin-lead anodes, cadmium anodes, brass anodes, silver anodes.

NICKEL SALTS:

Produced by ASARCO under constant quality control that assures full nickel content and identical plating characteristics from every lot.

PLATING ADDITION AGENTS:

Cadmax for still or barrel cyanide cadmium plating; Zimax in liquid or powder form; Nimax for low cost bright nickel plating.

Federated products:

Aluminum, Babbitts, Brass, Die Casting Metals, Fluxes, Lead and Lead Products, Magnesium, Plating Materials, Solders, Type Metals, Zinc Dust

You get better performance every time because Federated Plating Materials are COMPETITIVELY TESTED!

All performance tests conducted by Federated are competitive in order to prove that plating materials sold under the Federated name not only work, but work better!

At ASARCO's Central Research Laboratory no Federated product is approved for sale until it has been thoroughly tested against competitive products. It must contain specific advantages or a better combination of properties. If it doesn't, it isn't ready for sale.

This policy of testing competitively has resulted in many superior plating supplies. Among them are Conducta-Core lead anodes, which have greater throwing power, yet last three or four times as long as other lead anodes. Cadmax, addition agent for cadmium plating; Zimax, for zinc plating and Nimax, a nickel plating brightener, are other recent examples of Federated products developed and formulated to do a better job at lower cost.

The next time your Federated field representative stops in to visit you, ask him about competitive testing. Let him show you how the products he represents will actually work better. It will benefit you.


Federated Metals


Division of

AMERICAN SMELTING AND REFINING COMPANY

120 Broadway • New York 5, N. Y.

In Canada: Federated Metals Canada, Ltd., Toronto and Montreal

washes, rinses and dries screw parts coated with quenching oil and simultaneously cleans the tote pans containing the screws. The washer features a number of specially designed drum fixtures, constructed so that the tote pan containing the screws to be cleaned is clamped to the bottom of each fixture by a semi-automatic locking device. As each loaded fixture enters the washer it is slowly rotated as it passes through the washing, rinsing and drying cycles. When heavier work items are processed the drum fixture is gently rocked instead of rotated to prevent nicking of parts. Chemicals may be added to the rinse to provide the work with a rust inhibitor. The fixture with the tote pan containing the parts returns to the operator completely clean and thoroughly dry. The advantage of the washer is that batches of screw parts of different sizes can be fed into the machine consecutively without becoming mixed as they are processed. In addition, the problem has been solved of cleaning the tote pans for holding the clean processed screws.

Model RJ-WRD heats by steam, is operated by one man and processes a tote pan of parts every minute at normal operating speed. The machine is readily adaptable for efficiently cleaning stampings, small castings, machine and electrical parts.

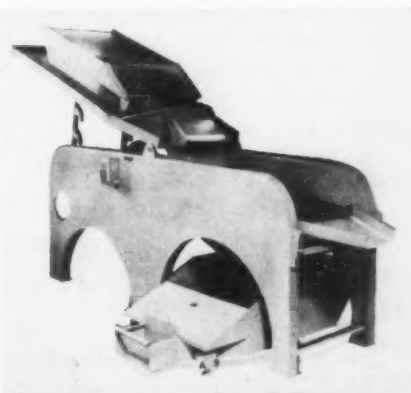
76/Circle on Readers' Service Card

Mechanical Separator

Metal Finish, Inc., Dept. MF, 412 Frelinghuysen Ave., Newark 12, N. J.

A new industrial type mechanical separator is stated to reduce handling costs up to 300%, and is built to fit nearly every need, since its versatile design is the result of a wide survey covering all important applications in the field.

It is fabricated of heavy steel construction for durability, and measures



**THE NEW VERSATILE
NON-DESTRUCTIVE
COATING-THICKNESS
TESTER**

DERMITRON



Unit Process Assemblies, Inc., pioneers in non-destructive testing and specialists in electronics for metal finishing, offer their latest DERMITRON D-2 with these features:

- Measures plated coatings on steel, brass, copper, zinc die-cast, aluminum, nickel-silver, bronze and other metals; also nickel on steel.
- Measures anodize and hard-coat on aluminum and magnesium; also paint, porcelain, organic coatings on non-ferrous metals.
- Measures metal coatings on plastics, ceramics and other non-metallic materials.
- Sorts or matches metals and alloys.
- Available with FOUR measuring probes for extra-wide thickness ranges from thin to thick deposits.
- Special probes can be provided for measuring on internal diameters, small diameters and otherwise inaccessible areas.
- Only $\frac{1}{8}$ " circle area required for measurement.
- You get fast (within seconds), accurate, direct readings, plus versatility and portability.

Write for latest brochure and questionnaire to help solve your thickness testing problems.

UPA

UNIT PROCESS ASSEMBLIES, INC.

61 East Fourth Street • New York 3, N. Y.

77/Circle on Readers' Service Card

96" long by 80" high by 37" wide. Engineered for fast separation, light or heavy parts can be handled with the same ease of operation. The unit also has an adjustable stroke ranging from $\frac{1}{4}$ " to $1\frac{1}{4}$ " which operates through an eccentric gear to achieve high speed production, in addition to small changes, with a varidrive expansion pulley.

78/Circle on Readers' Service Card

Abrasive Belt Polisher

Hammond Machinery Builders, Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

This new 10" abrasive belt grinder, Model PD-10 is especially suited for

dry, flat surface grinding, polishing and deburring. It can be adjusted quickly and easily to vertical or horizontal operating position. The 10" x 21" steel platen can be reversed top for bottom and side for side. The platen offers a working surface large enough to allow parts to contact the entire width of the belt.

Multi-V-belt drive, 5 or $7\frac{1}{2}$ HP motor and dynamically balanced drive and driven pulleys insure smooth operation. Automatic air or spring belt tensioning is available; however, automatic air tensioning is recommended for longer belt life and better finishing results. Standard belt speed is 3800 fpm, but other speeds are available.



The heavy-duty construction, net weight 850 lbs. provides the unit with enough weight to stand up through continuous production use.

79/Circle on Readers' Service Card

Purifier for Metal Cleaning and Cyanide Copper Baths

Northwest Chem. Co., Dept. MF, 9310 Roselawn, Detroit, 4, Mich.

Alkontrol, an improved replacement for sodium hydrosulfite, reduces the troublesome hexavalent forms of chromium contamination to harmless ones. The reduction, which is permanent, makes the new agent unusually economical. It's long term effectiveness relieves plant operators from constant attention and frequent additions to their cleaning baths.

When used in a copper strike, the product improves the deposition on copper casting patterns, improves plating in low current density areas and eliminates some causes of blistering. It is added directly to cleaning baths at the rate of $\frac{1}{4}$ oz./gal. Excess use is not harmful and carry-over from strike to bright copper causes no ill effects.

The material is also effective in rack stripping baths.

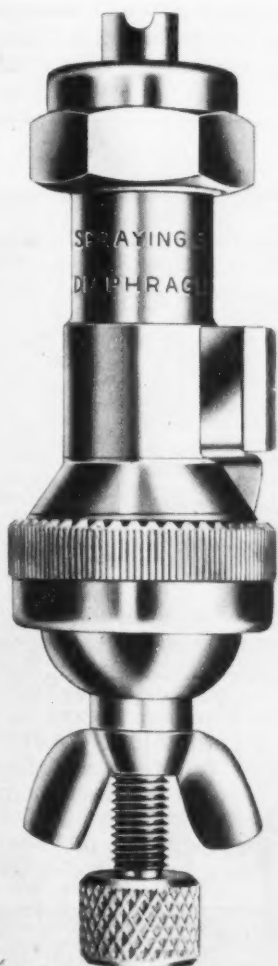
80/Circle on Readers' Service Card

Diaphragm Spray Nozzles

*Spraying Systems Co., Dept. MF,
3245 Randolph St., Bellwood, Ill.*

A new spray nozzle equipped with manually operated shut-off assembly, is designed primarily for manifold installations, where selected nozzles must be independently shut-off to meet varying spraying requirements. Construction of the nozzle includes a diaphragm valve, shut-off screw and wing nut. To close the nozzle, the shut-off is turned down to hold the diaphragm in place. When the shut-off screw is set in open position, the diaphragm valve functions to shut-off the nozzle as soon as the manifold line is closed, eliminating any dripping that might otherwise occur as line pressure is reduced.

These new nozzles are made in brass with internal Monel metal strainer. A wide choice of interchangeable orifice tips are available covering a considerable capacity range as well as selection



of full cone, hollow cone and flat spray patterns.

81/Circle on Readers' Service Card

Why buy **BLAKESLEE** DEGREASING MACHINES

*PATENTS can be secured on almost anything.
The item patented need not be practical
or offer any worthwhile contribution.*

PROFIT PRODUCING PATENTS

Practical BLAKESLEE patented features result in economies of operation and savings in solvent consumption. The BLAKESLEE patented anti-diffusion chamber on conveyorized machines cut-off the evaporative area from 50% to 80%.

Another practical patented feature found only on BLAKESLEE degreasers is the patented solvent cooler. This cooler is located just ahead of the water separator and chills the solvent distillate to speed up and insure complete and constant separation of the water and solvent.

OPERATING COSTS

These costs are the most important to consider when deciding on new degreasing equipment; actually the initial machine cost is secondary. The patented features listed here are typical of the many, many features to be found only in BLAKESLEE degreasers.

It will pay YOU to have a BLAKESLEE man call!

G. S. BLAKESLEE & CO. 1844 So. Laramie Ave., Chicago 50, Ill.
NEW YORK • LOS ANGELES • TORONTO
also Manufacturers of Blakeslee Metal Parts Washers and Blacosolv Degreasing Solvent

82/Circle on Readers' Service Card

Rubber Gloves

*Wilson Rubber Co., Industrial Div.,
Dept. MF, 1200 Garfield Ave., S. W.,
Canton 6, Ohio.*

New reinforced gloves feature Firmhold fingers and palms, which provide a secure grip for handling heavy objects. Roughened patches offer longer wear and greater resistance to punctures and snags, and are ideal for steam cleaning or sand blasting operations.

The gauntlet-type acid gloves are linemen's rejects, having slight surface irregularities which in no way effect performance. Acid gloves are made of 30 to 40 dipped layers of natural rubber, and have all the wearing qualities

of first-grade high voltage linemen's gloves.

Reinforced gloves are available in medium weight (.045-inch thickness), in sizes from 9 through 12, and in 14- and 18-inch lengths. The gauntlet-type gloves are available in heavy (.060-inch thickness) and medium weights, sizes 9 to 12, and in 14- or 18-inch lengths.

Hand-fitting, curved finger styling, providing comfort and flexibility, is an outstanding feature of both gloves. Wil-Gard Industrial Gloves also are made from Neoprene, Latex and Buna-N and Compar Plastic, covering a wide range of industrial uses.

83/Circle on Readers' Service Card

Plastisol Lined Drums

Coating Div., Michigan Chrome and Chem. Co., Dept. MF, 275 Iron St., Detroit 14, Mich.

A new line of corrosion-resistant drums and buckets, coated with Microsol vinyl plastisol inside and out, is claimed to be ideal for storing acids, caustics, plating solutions, and all types of corrosives. The lining is bonded to the steel and its extreme toughness makes it highly resistant to physical damage.



Drums are available in 55 and 30 gallon sizes with securely welded handles for easier handling. They can also be ordered without handles, if preferred. Buckets are 5 gallons.

84/Circle on Readers' Service Card

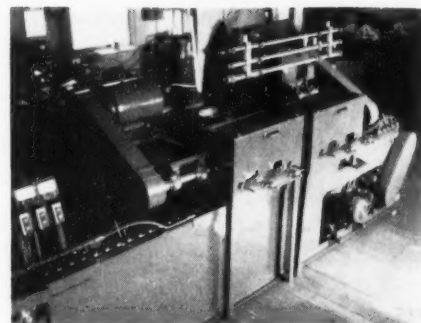
Straight-Line Polisher

Arthur H. Losey Co., Dept. MF, 110 S. Horton St., Jackson, Mich.

The above firm announces its straightline polishing machine with special mechanical features which are said to make possible the production of small parts at high production, with a minimum of labor.

Only one operator is required, to place the parts on the conveyor. A specially designed cam-operated locking device automatically secures the parts while they are being processed. After polishing and/or buffing, another cam track releases the parts, which are automatically unloaded from the conveyor, according to the manufacturer.

The controls and ammeters are installed in front of the operator at the



load end of the machine so that constant check on wheel pressures may be observed, and periodic adjustments made.

85/Circle on Readers' Service Card

Lightweight Face Shield

Chicago Eye Shield Co., Dept. MF, 2300 Warren Blvd., Chicago 12, Ill.

A new face shield combines unusually light weight and strong, tough wearing qualities. The Cesco No. 438-FT is constructed of translucent fiber glass material. It employs the new GI-R headgear for quick and easy fitting, and is easily tilted up off the face.

86/Circle on Readers' Service Card

The FOAMING ETCH BLUES

Quick, Joe, dump some more solution from this etching tank! It's foaming so much it's going up the stack and spraying the cars outside.

It's the high concentration of etchant and the high temperature you have to use in your tanks that causes this terrific foaming. Pennsalt Aluminum Etchant 16 will let you operate twenty degrees cooler, and you'll need only half the concentration you're using now.

But remember, Steve, we can't afford to stain or streak these extrusions.

Don't worry about that, Ernie. AE-16® built its reputation on a fine satin etch—and no scale in the tanks, either! Let me send you a drum tomorrow.

High-Vacuum Pump

Rochester Div., Consolidated Electro-dynamics Corp., Dept. MF, 1775 Mt. Read Blvd., Rochester 3, N. Y.

A new high-vacuum pump, known as the Evapor-Ion pump, Type EI-2000A, provides an electronic method for producing high vacuum without the use of organic pump fluids. The pump is the only device available that creates a "dry" vacuum in the range from 10^{-4} to 10^{-8} mm Hg. It pumps active gases by the gettering action of evaporated titanium wire, and pumps inert gases by ionizing and burying them under a layer of titanium. Continuous titanium wire evaporation is assured by an improved feeder mechanism. Operation is now possible for periods up to six months or longer without breaking vacuum for pump servicing.

This latest model has a pumping speed of 1900 liters per second for nitrogen, 1000 liters per second for oxygen, and 3000 liters per second for hydrogen. It also pumps many other gases, including water vapor, at high

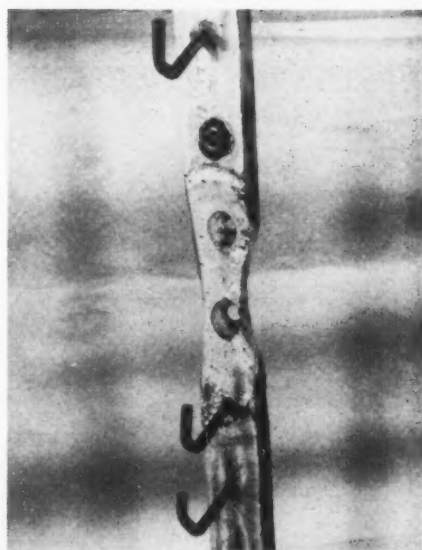
speed. No refrigerated traps or baffles are required. Mechanical forepressure pumping for continuous operation is not needed.

87/Circle on Readers' Service Card

Titanium Wire for Anodizing Racks

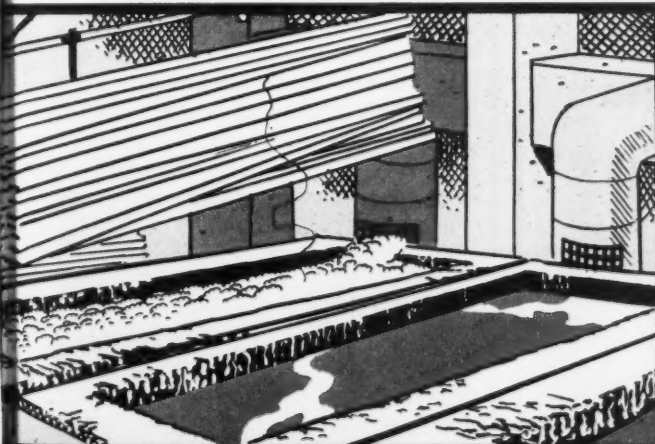
Johnston & Funk Titanium Corp.
Dept. MF, W. Kemrow Ave., Wooster, Ohio.

Titanium wire 75A, a commercially pure titanium alloy with an average yield strength of 75,000 psi, has been



developed to replace aluminum tips on anodizing racks. The new titanium wire has resisted the chemical attack of cleaning, etching, brightening and anodizing solutions so completely, that it is proving more economical for anodizing tips than aluminum.

In using the wire, which is being drawn from 0.25" down to 0.030", no



A MONTH LATER...

Well, Ernie, how did you make out with the Pennsalt etchant?

Fine, Steve! No more of that annoying foam, no more scale problem in the tanks, and we're getting a fast, clean etch with Pennsalt AE-16. Thanks for pulling me out of a tight spot.

You know, Ernie, while Steve Choren from Pennsalt was in yesterday to adjust our phosphating cycle, he looked this over and thought he had the answer.

Let's get him here fast.

No matter what the metal or the problem, take advantage of Pennsalt's wealth of know-how in metalworking chemistry. Call your Pennsalt salesman or send the coupon to get "A BETTER START FOR YOUR FINISH."

Pennsalt Chemicals Corp., Dept. 545
3 Penn Center, Philadelphia 2, Pa.

Send information on Pennsalt

☐ metal cleaners ☐ phosphate coatings
☐ cold-working lubricants.

**Pennsalt
Chemicals**

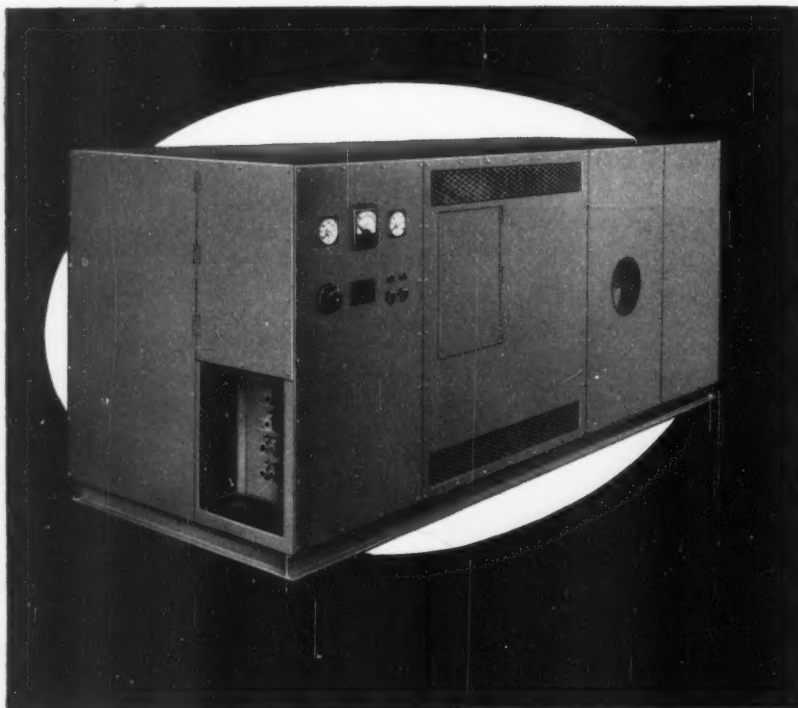
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Efficient, Low Cost a-c to d-c power conversion in one single, space-saving unit



SYNTRON SELENIUM RECTIFIER POWER CONVERSION UNIT

—designed to meet the rigid power requirements of the Metal Finishing Industry. They are low voltage and high amperage units for electro cleaning, plating, polishing and electro chemical purposes. They are sturdily constructed, using SYNTRON'S own Selenium Rectifier stack assemblies to assure long life with dependability and low maintenance. Built as a single compact space-saving unit rated for continuous operation. Either fan cooled, convection cooled or oil immersed units. Easy to install — easy to maintain.

Solve your a-c to d-c power conversion problems efficiently and economically with SYNTRON Power Conversion Units.

Builders of Quality Equipment for more than a Quarter--Century.

SYNTRON COMPANY
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Homer City, Penna.

design changes are necessary in the manufacture of titanium-tipped racks. Forming techniques applicable to stainless steel spring wire, work equally well with titanium wire. It is strong enough to hold shape under load, yet ductile enough to permit forming of small radii clips.

Special welding equipment and cleaning procedures beyond normal practice are not required for welding the wire, and welding operator training and skill need not exceed that commensurate for the welding of aluminum.

90/Circle on Readers' Service Card

Mushroom Discs and Pads for Contour Polishing

Behr-Manning Co., Dept. MF, Troy, N. Y.

For contour grinding or polishing in small radii or difficult contours with portable tools, a new mushroom shaped molded rubber pad and coated abrasive discs, currently available in diameters of 5 and 8 in., were designed specifically for getting into contours where disc pads of conventional type may not perform effectively. With the new pad, it has become possible in many cases to do an entire contour in one operation. Also, swirl marks and gouges are virtually eliminated, so that the usual subsequent finishing operation can often be dispensed with.



No center nut is required to fasten disc to pad. Instead, discs are held to the pad by a special adhesive packaged in tube applicators. Abrasive discs are made in Resinall Metalite cloth, an aluminum oxide abrasive with an all-

resin bond, in grits 120-X, 80-X and 50-X.

Pads of 5 and 8 in. diameters are made in the proper density for polishing; a third mushroom pad in 5-in. diameter is made in a harder density for stock removal. All may be used on any portable pneumatic or electric grinder.

91/Circle on Readers' Service Card

Temperature Regulator

Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Dept. MF, Box 400, Knoxville, Tenn.



A self-operated temperature regulator for use exclusively in metal finishing processes is claimed to provide accurate temperature regulation in plating, phosphating, anodizing, cleaning, pickling, and rinsing solutions. The use of special metals and plastics in the regulator, it is stated, insures long operating life and dependable performance. A resistant plastic has been used to coat the temperature sensing bulb and connecting tube. Stainless steel is used for the frame. The body of the valve is made of a non-ferrous metal.

The new temperature regulator, called No. PA-2, is available in seven valve sizes from $\frac{1}{4}$ " to $1\frac{1}{2}$ ". Several bulb sizes are also available.

The regulator is equipped with a hand wheel to adjust temperatures within the limits of a selected range. A large, easily read thermometer is at the crown of the regulator.

92/Circle on Readers' Service Card

Scrubbing Machine

The Fuller Brush Co., Machine Div., Dept. MF, Hartford 15, Conn.

An industrial scrubbing machine has

A black and white photograph of a hand holding a piece of paper. The paper contains text about a new material called Duracor. The background is dark and out of focus.

Here is important information on newly developed corrosion resistant fume ducts and fume hoods for the handling of vapors from virtually any chemical.

We have proudly named the new material

DURACOR

Fabricated from specially compounded thermo-setting plastics which are combined with glass and other synthetic fibers, Duracor hoods, ducts, tanks and process equipment can be supplied in almost any shape. Chemical resistance, lightweight, strength, easy workability as well as attractive appearance are only some of the features.

Duracor shapes can have tensile strength up to 15,000 psi and flexural strength up to 30,000 psi.

Duracor is chemically inert throughout its thickness. Linings for interiors and coatings for exteriors are completely eliminated.

Why not write today and get complete details. We welcome your inquiry and will give it immediate attention. Send your request to The Ceilcote Company, Inc., 4844 Ridge Road, Cleveland 9, Ohio.

DURACOR is another development of CEILCOTE!

7522-CC

PIONEERS and LEADERS



in ELECTROLYTIC PRECIOUS METALS

Through the years, Davis-K has continued to lead the field in producing low cost solutions, time-saving procedures and revolutionary new electroplates. From Davis-K research laboratories have come two of the most outstanding developments in recent years.

ONE OPERATION

First with Antique Gold Solution

An inexpensive, quality electroplate with excellent color consistency and remarkable ease of operation.

First Again with HARD GOLD SOLUTION

FOR PRINTED CIRCUITS AND ELECTRONIC PARTS

Davis-K Hard Gold Plating Solution is an amazing new electroplate for the electronic industry which cuts gold deposit 50% while forming a lasting bond with either metals or plastics. Requires no elaborate set-up, has maximum resistance to high frequency, plates at low temperature and eliminates control problems.

OTHER DAVIS-K PRODUCTS

★ POTASSIUM GOLD CYANIDE SALTS

★ LUSTROUS WHITE RHODIUM SOLUTION

Now available: variable-type Tank Rheostats, specially designed for precious metal plating.

FREE Consultative Service!

As an added service, Davis-K process engineers are available for consultation concerning special plating problems and installations.

ALL DAVIS-K GOLD PLATING SOLUTIONS ARE:

- made in all colors
- color constant
- tarnish-resistant
- brilliant in finish
- bottled by Troy weight
- made from assayed US Treasury Gold only
- Ready for immediate use

We are fully equipped to reclaim old gold and rhodium solutions. No charge for small sample plating. Write Dept. MFG-57 for details!

"Where Glittering Elegance Reflects Lasting Quality."



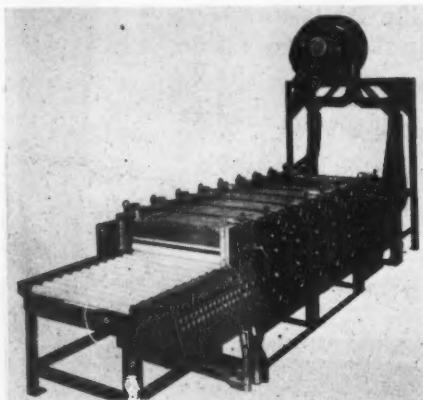
DAVIS-K
PRODUCTS, CO.

135 West 29th St., New York 1, N. Y.
Longacre 4-1978-9

94/Circle on Readers' Service Card

been specially designed to clean both the top and bottom surfaces of flat stock metal plates.

Two versions of this machine are



available. The longer machine, for cleaning extra heavy accumulations of surface dirt, is equipped with eight sets of scrubbing brushes, six for scrubbing and two for scrub-rinsing away residual detergent solution, and will process sheets up to the rate of 100 feet per minute. The shorter version of this machine has three sets of brushes, two for scrubbing and one for rinsing, and cleans flat metal plates up to the rate of 60 feet per minute. Both have a maximum width capacity of 38 inches.

A detergent and water solution is pumped onto the plates as they are conveyed through the machine by means of feed rolls. They are then scrubbed and scrub-rinsed with nylon cylindrical

brushes. Following this scrub-rinse, the plates pass through an air-squeegee and come out clean, dry, and ready for the subsequent operations.

95/Circle on Readers' Service Card

Polyethylene Fiber Filter Cloth

National Filter Media Corp., Dept. MF, 1717 Dixwell Ave., New Haven, Conn.

Polymax filter cloth is manufactured from high density polyethylene. Tensile strength is in the range of 50,000 to 100,000 psi and elongation ranges from 5% to 10%. The material has a softening temperature of 260°F. The fabric is finished so that exposure to temperature in the 230°-240°F. range results in minimum shrinkage. In general, it is stated to equal or exceed the chemical resistance of conventional polyethylene. Samples and test data are available on request.

96/Circle on Readers' Service Card

Cleaner for Printed Circuits

The Clarkson Laboratories, Inc., Dept. MF, Philadelphia 23, Pa.

Clarco CPC is a non-toxic, non-inflammable liquid concentrate designed to remove oxide and soil from printed copper circuits. Its aqueous solutions are alkaline and have low surface tension, thereby rapidly and uniformly wetting out copper and plastic surfaces, according to the manufacturer.

Also used as a fast, efficient cleaner and brightener for printed circuits, the product cleans without damage to the plastic and copper circuit components. The copper is said to be left extremely bright and ready for soldering.

When diluted in the ratio of 4 fluid ounces per gallon of water, the solution can be prepared and stored in any type of container except aluminum and galvanized metal. The solution is applied by brushing, spraying or dipping and, for most applications can be used at room temperature but, where faster reaction is needed for production, it can be warmed to 120°F.

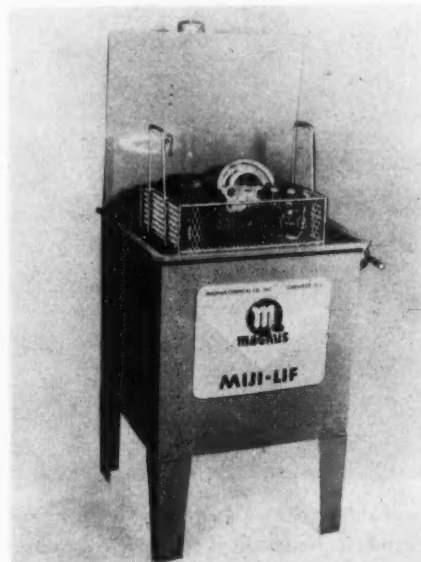
The solution should be removed from cleaned circuits by rinsing well with warm or cold water, and the parts allowed to dry in air. It is a fairly strong alkaline solution, and the manufacturer states that contact with the skin should be avoided.

It is packaged in 5, 30 and 55 gallon drums.

97/Circle on Readers' Service Card

Cleaning Machine

Equipment Div., Magnus Chem. Co.,
Inc., Dept. MF, Garwood, N. J.



The "Miji-Lif" has been designed for batch cleaning of all types of parts in solvents, mild acids, and alkalis. Up to 75 pounds of work can be cleaned at a time. This unique and versatile machine can also be used for applying protective coatings to metal parts. It's all done with compressed air (no electrical appliances or connections—no fire hazard).

With single lever operation, a flick of the operating lever brings the platform to the top of the tank, out of the liquid for inspection, loading and unloading the work. Then a second flick of the lever lowers the platform to the bottom of the tank where the work is immediately, automatically agitated up and down in the solution, "shearing" the dirt from the parts and eliminating hand scrubbing.

The machine is available in a 30 gallon size with a working platform of 21" x 18". Unheated or electrically heated models are available.

99/Circle on Readers' Service Card

Automatic Loader

Michigan Crane & Conveyor Co.,
Dept. MF, 115 N. McKinstry Ave.,
Detroit 9, Mich.

A new line of "Man-O-Steel" automatic loaders is available for heat-treat furnaces, plating lines, and continuous tumbling.

The loader will deliver 500 to 5,000 pounds of small stampings, screw machine parts, or even castings and forging. The manufacturer claims that feed rates will not vary more than 5%.

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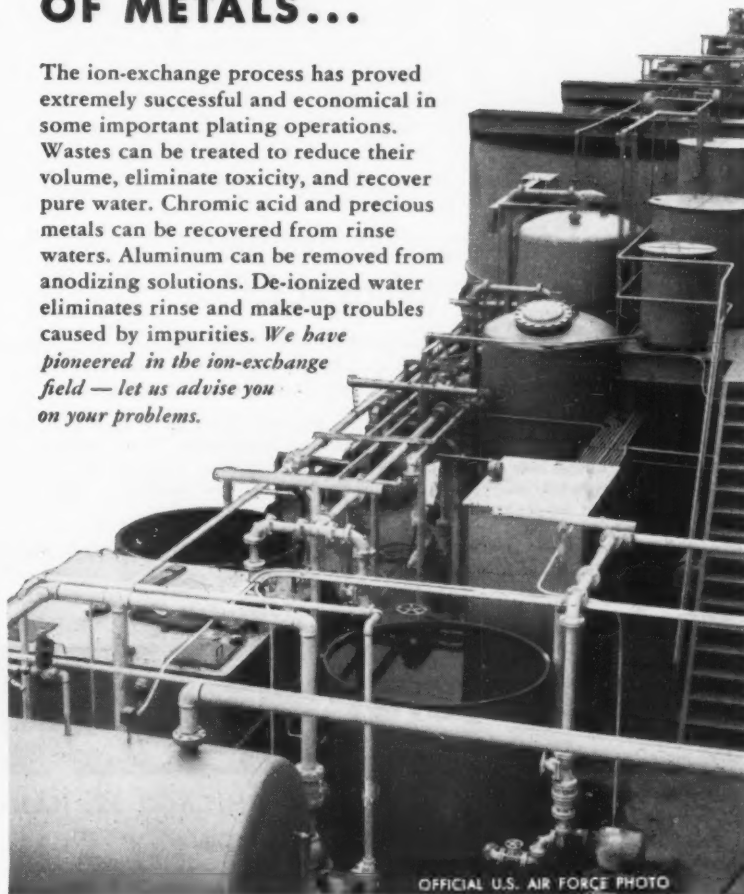
ILLINOIS WATER TREATMENT CO.
840 CEDAR ST., ROCKFORD, ILL.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.
NEW YORK OFFICE: 411 E. 44th St., New York 17, N.Y.

ILLCO-WAY

ionXchange

FOR WASTE TREATMENT AND RECOVERY OF METALS...

The ion-exchange process has proved extremely successful and economical in some important plating operations. Wastes can be treated to reduce their volume, eliminate toxicity, and recover pure water. Chromic acid and precious metals can be recovered from rinse waters. Aluminum can be removed from anodizing solutions. De-ionized water eliminates rinse and make-up troubles caused by impurities. *We have pioneered in the ion-exchange field — let us advise you on your problems.*



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pH Meter

Photovolt Corp., Dept. MF, 95 Madison Ave., New York 16, N. Y.

While being compact and moderately priced, Model 85 is a fullfledged, line-operated pH meter. Its scale is 3" long, covers the complete pH range from 0 to 14 and can easily be read to an accuracy of 0.1 pH unit. It is suited for pH tests as well as for titrations, and can be furnished either with individual glass and calomel electrodes, or with "probe" electrode, i.e. combination glass-and-calomel electrode.

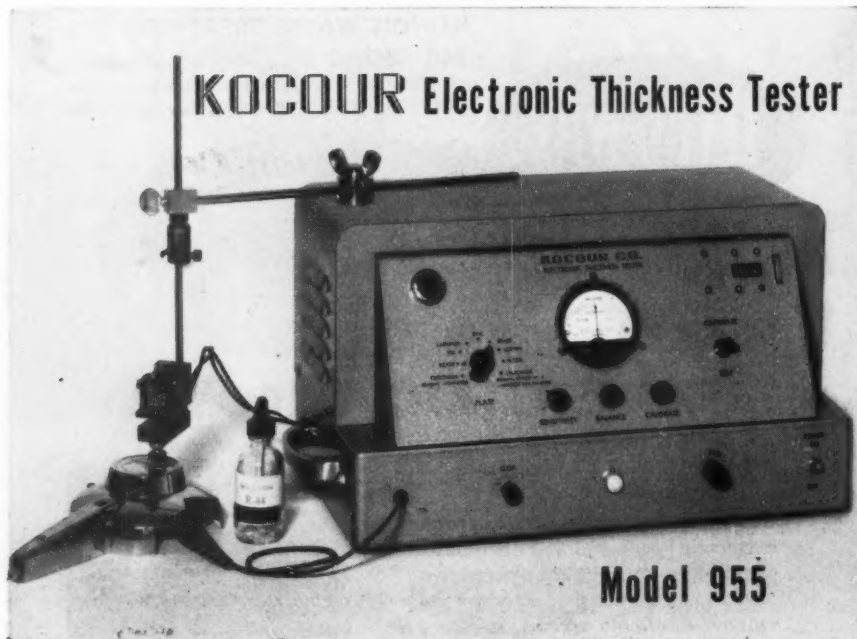
102/Circle on Readers' Service Card

Coupling Koroseal Pipe

B. F. Goodrich Industrial Products Co., Dept. MF, Marietta, Ohio.

A "quick" coupling that can be assembled and disassembled in seconds has been developed from high impact Koroseal polyvinyl chloride pipe. The new coupling is recommended for temporary chemicals, oil, water or disposal lines.

To install, the grooved end of the pipe is pushed into the coupling until the thrust ring seats in the groove. To disassemble, a disassembly tool is set



PLATING THICKNESS TESTER PROVES ITS ACCURACY

Model 955 features a wider application than most other methods . . . direct readings with an accuracy of 90-95% . . . quick, simple and automatic operation . . . reproducible results and, human error is virtually eliminated.

Most important to you is the new calibration feature which is used in conjunction with accurately prepared Kocour Thickness Standards. This feature not only provides a check on the accuracy, but in addition a quick calibration adjustment will automatically correct slightly high or low readings. Thus, you get proven accurate readings direct from the instrument panel.

Model 955 may be the answer to your plating thickness problems. Don't hesitate . . . get the details today!

Ask for a demonstration or 15-day Free Trial!



4802 S. ST. LOUIS AVENUE

CHICAGO 32, ILLINOIS

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in place and the pipe pulled out of the coupling.

The coupling will take up to 10-de-



gree misalignment in pipe joints.

Koroseal pipe is unaffected by most acids and alkalis as well as salt, oil, water and alcohol solutions and has found wide use in industry to handle chemicals that attack more expensive rubber, metal or alloy products.

104/Circle on Readers' Service Card

Drum Liner

American Agile Corp., Dept. MF, 5461 Dunham Road, Maple Heights, Ohio

This liner, of 1/4" polyethylene, is designed for steel cylindrical tanks having a flat bottom and no inside metallic welds.



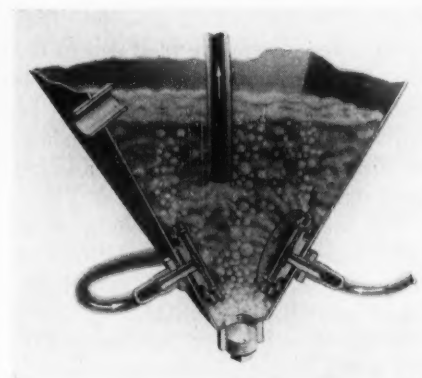
Tanks can be furnished already lined, to be shipped to the customer as an integral functional unit, or the liner can be fabricated to specification separately and inserted by the user company.

The liner is fitted with a roll lip to cover the top edge of the steel supporting the drum to avoid spillage of liquid between the liner and the container.

105/Circle on Readers' Service Card

Abrasive Slurry Agitator

Pangborn Corp., Dept. MF, Hagerstown, Md.



Designed to prevent the solid packing of abrasive at the bottom of the tank after overnight shutdown, the new Sluriator eliminates the need for a mechanical pump and auxiliary equipment and can be adapted to conical-bottom tanks by means of a conversion kit.

The unit consists of a 4-inch diameter compressed air distributor set between two heavy gage Wear-Resist alloy circular plates. Two such fittings are installed at the base of the sloping side

walls of the abrasive slurry tank, as illustrated, so that the agitating air strongly sweeps the tank bottom as well as spirals through the body of the liquid to provide rapid and thorough agitation of the slurry.

The only equipment required to supply the new unit is a take-off from the regular 80 to 90-lb compressed air line necessary to operate the nozzle, and a needle valve to regulate the air flow at 6 to 10 cfm.

106/Circle on Readers' Service Card

Manufacturers' Literature

Hard Bright Gold Technic, Inc.

Detailed information on hard bright gold is compactly presented in a new brochure. Specifically, data are given on HG gold, and several typical applications in the electronics field are detailed.

Operating data are supplied, together with directions for preparation and aging and for replenishment based on maintaining concentration within 5 per cent.

107/Circle on Readers' Service Card

Reverse Current Cleaner Oakite Products, Inc.

The use of Composition No. 90 for reverse current cleaning of steel before plating is the subject of a recently published service report.

108/Circle on Readers' Service Card

Anodes and Plating Chemicals Hanson-Van Winkle-Munning Co.

A new 12-page, two-color bulletin AC-110 describes and illustrates a full line of anodes, anode accessories and chemicals for electroplating and metal finishing.

Specifications and recommended applications are given for seven styles of anode bags, three types of diaphragms and eight types of anodes. The bulletin describes a number of salts commonly used in electroplating baths and 13 brighteners. It also lists the standard package sizes for these products.

Anodes described include nickel, cadmium, brass, copper, tin, zinc and lead. Various types of nickel anodes



Photo courtesy: Hanson-Van Winkle-Munning Co.

Tests Prove These Linings Can't Be Separated!

Manhattan engineers have developed a method of bonding metal to rubber so securely that actual mechanical pull tests prove it can't be separated. Thick, multiple calendered sheets of natural or synthetic rubber are inseparably bonded by Manhattan lining specialists to assure you permanent protection against the corrosion and abrasion of your equipment or contamination of process solutions. They eliminate the dangers of stray currents in plating operations . . . won't harden or crack . . . even under extreme temperature changes.

Whether your plating equipment is large or small, intricate or simple . . .

Manhattan has the facilities to efficiently handle your rubber lining needs. To make certain your lining is flawless and permanent, every piece of equipment lined by Manhattan is tested under high voltage to detect any possible defects. Many Manhattan Rubber Lined plating tanks have been in continuous use for over thirty years!

Make certain you have permanent protection against corrosion, contamination and abrasion in your costly plating operations. Let the R/M lining engineer at the plant nearest you show you how you can get "More Use per Dollar" with an investment in Manhattan Rubber Linings.

RM 224

RUBBER LINING PLANTS AT PASSAIC, N. J. • NORTH CHARLESTON, S. C.



MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY
RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose Fan Belts • Brake Linings & Blocks • Clutch Facings • Packings • Asbestos Textiles Engineered Plastic, and Sintered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

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are listed along with recommended applications and pH ranges. Two pages of line drawings tell how to order hooks for round, flat and shaped lead anodes.

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Plastic Coatings

American Agile Corp.

"Fluidized Plastic Coatings For Corrosion Resistance" is the title of a special report, available in literature form. The six-page literature, a reprint of a feature article, covers such topics as the mechanism of fluidization, coatings available, cost factors, and applications.

More than a dozen photographs illustrate typical parts that can be

fluidized coated; other illustrations show how the powder dip process provides a uniform corrosion-resistant plastic coating on the various intricate shapes.

In addition, two tables provide technical data on (1) corrosion resistance of fluidized polyethylene coating, and (2) fluidized coating materials.

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Rigid Polyvinyl Chloride Pipe

Alpha Plastics, Inc.

A 12-page two-color catalog describes the firm's regular and high impact corrosion-resistant rigid polyvinyl chloride pipe.

Included are tables of pipe sizes available, specific chemical applica-

The Leading Name in Immersion Heating



TYPE "U"
PATENT PENDING
World's first successful U-tube
ACID Heater
—Guaranteed to outperform and outlast all other quartz heaters.

TYPE "GN"
Pat. No. 2,740,881
Standard straight tube Quartz
ACID Heater
—Vapor-proof junction box; replaceable heating element.

TYPE "MB"
"Multi-Blade", Metal-sheathed
ALKALI Heater
—Portable, burn-out proof, easy mounting, long life.

- INSTANT HEATING
- SHORT-PROOF
- AVAILABLE IN ALL VOLTAGES—WATTAGES, one and three phase
- STOCKED FOR IMMEDIATE SHIPMENT



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ACCURACY—EFFICIENCY—LONG LIFE—and ECONOMY
...you'll get it with Glo-QUARTZ!
Available from your Electroplating Distributor!

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tions, physical properties, temperature factors for various working pressures, support spacing and thermal expansion.

Flow charts, installation instructions, pipe characteristics and fields of application also are included.

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Sealless Pumps

Vanton Pump & Equip. Corp.

A new and comprehensive eight-page catalog, No. 10.0, describes the manufacturer's "Flex-i-liner" sealless plastic and stainless steel pumps and contains useful technical data and material selection information.

The catalog includes an explicit description of how the pumps work, per-

formance data with pump characteristic curves and charts with sizes, capacities, operating pressure ranges, and other data.

Materials of construction are discussed in detail with general chemical service of all plastic and synthetic housings and liners described.

This is followed by a detailed materials selections chart that indicates the recommended materials for body blocks and liners for more than 120 specific chemical solutions. The bulk of this data is based on actual field results. The new catalog also includes listings of typical industrial applications.

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OBITUARY

FREDERICK GUMM

The plating industry lost an enthusiastic and staunch friend in the passing of *Frederick Gumm* after a brief illness on September 12.

Mr. Gumm had been active in the plating industry for just short of a half century and his passing will be a loss to many of the elder generation of platers, as well as to his immediate family and host of friends. As a business man, he was energetic and a hard worker. As a man, he had a warm, sentimental affection for his friends; and when he trusted and liked a man he would do all he could to help him. He was well-known and active for many years in the American Electroplaters' Society and the International Fellowship Club, now the Metal Finishing Suppliers' Association, of which he was a former president.

Mr. Gumm was a native of Hoboken, N. J. and after finishing school in 1908, he entered the electroplating industry with the William Schimper Co. He later was associated with Diehl Motor Company and National Carbon Co. In 1929, he formed the Hesse and Gumm Company, makers of alkali cleaners.

The Frederick Gumm Chemical Co., Inc., was formed in 1932 in partnership with *C. R. Percival* and shortly thereafter, *Oliver J. Sizelove* joined the company. The company has



Frederick Gumm

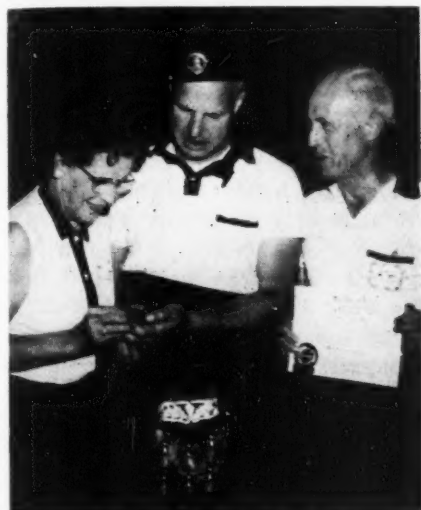
grown in both size and scope for a quarter of a century under the able direction of Fred Gumm as president.

He was also a member of the Kearny Lodge, F. & A. M. and B.P.O.E. and the Army Ordnance Association.

He is survived by his widow, Nellie (nee Swick); a daughter, Ruth (Mrs. Robert R. Sizelove), his son John Gumm and a number of grandchildren.

BUSINESS ITEMS

MacDermid, Inc. Presents Award to Thornton



Dressed in the traditional Scottish Tam, Kilt and Sporan of the "MacDermid Clan," *Harold Leever*, president of *MacDermid, Inc.*, Waterbury, Conn. manufacturer of metal cleaning, plating and finishing chemicals, presents a special Wives' Award to *Mrs. Cecil Thornton*. Looking on is *Cecil Thornton*, Rochester, New York sales representative, holding his 20 year Service Award.

International Rectifier Corp. Announces New Facilities

Coincident with its tenth anniversary, *International Rectifier Corp.* of El Segundo, Calif., has recently occupied two new facilities, bringing the number of plant buildings in the area to seven.

The new contemporary structure located at 233 Kansas St. covers 18,000 square feet, features radiant heating in the floor, and is completely air conditioned for year 'round comfort. This administration building is unique in that it is built around a central patio which provides an abundance of nat-



ARE YOU ONE OF THE MANY SATISFIED USERS OF . . .

 <p>SPEKWITE Patented</p> <p>Triple alloy Brilliant White Electroplate Harder than Nickel — Tarnish Resistant. Copper - Zinc - Tin.</p>	 <p>SPEKYELLO Patented</p> <p>Triple alloy Yellow Bronze Electroplate Uniform results — Ends Color Matching — Simulate 14 kt. color. Copper - Zinc - Tin.</p>	 <p>DIPWITE Patented</p> <p>Immersion tin coating for copper, copper plated, brass and brass plated parts. Increases solderability.</p>
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If you have not tried these proven dependable finishes, write for descriptive literature and simple operating instructions.

Standards in the industry . . .
improved and updated to conform with modern plating practice.



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Telephone: Wilson 1-5052

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ural light and a pleasing view to the offices surrounding it. Constructed of steel, red brick, glass and redwood, it houses the executive, sales, accounting

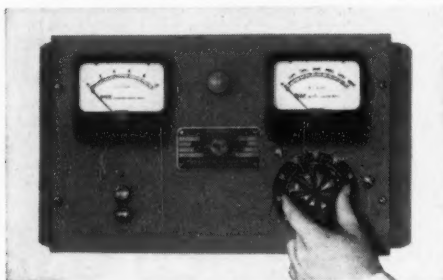
and purchasing offices of the firm. Approximately 10,000 square feet are devoted to the production of silicon and germanium power rectifier junctions.

NOW

BALANCED
SINGLE KNOB

STEPLESS CONTROLLED PLATING RECTIFIERS

**GERMANIUM
SELENIUM
SILICON
RECTIFIERS**
WITH



"Finger-Tip" Control Panel 10" x 18" x 6"

REACTRON MODIMATIC CONTROLS

- STABILIZED OUTPUT VOLTAGE
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- NO FLOOR SPACE
- SMALL INTERCONNECTING WIRES
- "FINGER-TIP" CONTROL
- NO MOVING PARTS
- LOW MAINTENANCE

*Controls all phases
simultaneously—
Avoids possibility of damaging
germanium junctions.*

The Ther REACTRON MODIMATIC CONTROL gives you instantaneous, perfect, stepless control of plating voltage. Stabilized output produces better plating. Single control knob controls all phases simultaneously...No possibility of damaging germanium junctions by improper setting of 22 or 44 position tap switches.

The miniature operator's control panel furnished with all MODIMATIC CONTROLLED rectifiers gives you "finger-tip" control where you want it. Can be mounted right at the plating tank—Requires no floor space—Measures only 10" x 18" x 6"—needs only #14 wires to control panel.



WRITE TODAY for technical study showing the advantages of Reactron VS. tap switch or motor driven variable auto-transformer controls.

It's THER... Whatever your D-C Requirement

THER ELECTRIC & MACHINE WORKS

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capacities with the company. He was elected a vice president in 1952, and was made a director in April of this year.

Lasalco Appoints New Texas Representative

Lasalco of Texas, Inc., has announced the appointment of J. C. Bessonette as representative for the Texas area. The new office and warehouse are located at 2805 Allen St., Dallas, Texas.

Mr. Bessonette has been with Lasalco, Inc., Saint Louis, for 14 years. His long experience in the industry qualifies him to serve customers in the Texas territory with expert advice on all plating and finishing shop problems involving both equipment and supplies.

Kelite Appoints Cunningham

Lawrence W. Cunningham has been promoted to Southern Region sales manager by Kelite Corp., manufacturer of industrial chemicals and steam cleaning equipment. He joined the company in September, 1956, as Dallas, Tex., district sales manager. Prior to his appointment, he was associated with Oakite Products, Inc., as technical service representative. His background includes experience in the petroleum and petro-chemical industries. He is affiliated with the National Association of Corrosion Engineers, American Petroleum Institute, American Ordnance Association, and the American Association of Pulp and Paper Mill Superintendents.

Mr. Cunningham will be in charge of sales in Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North

Elections at Wagner Brothers, Inc.

At a stockholders' meeting in Detroit recently, J. R. Wagner, P. H. Richey, F. M. Mansfield III and Bruno Leonelli were elected to the board of Wagner Brothers, Inc., manufacturer of custom-made automatic plating machines, allied equipment and chemicals.

The board of directors, in a subsequent meeting, re-elected the following officers: J. R. Wagner, president; J. E. Hunt, vice president; J. E. Keyes, vice president; F. M. Mansfield III, vice president of sales, and Bruno Leonelli, vice president of research. The board also elected P. H. Richey to executive vice president, a newly-created post.

Asarco's Bradford Appointed to New Post

R. D. Bradford, vice president and president and director of American Smelting and Refining Co., has been placed in charge of the company's Federated Metals Division, which has 24 plants in the United States, and produces brass and bronze, aluminum and zinc alloys, type metals, plating supplies and electrochemicals, zinc and magnesium galvanic anodes, solders, babbitts and other non-ferrous metal supplies.

A native of Salt Lake City, Mr. Bradford has been an employee for 31 years, and has served in numerous



Lawrence W. Cunningham

Carolina, Oklahoma, South Carolina, Tennessee, Texas and part of Kansas and Missouri. He will make his headquarters in Beaumont, Tex., where he resides.

International Chemical and Metallurgical Supply Opens Offices and Warehouse in Southern Florida

International Chemical and Metallurgical Corp. has opened offices in the Sweet Building in Ft. Lauderdale, Florida to supply the requirements of the metal finishing and metallurgical industries in Florida and Latin America. The corporation will handle a complete line of supplies and equipment representative of the leading manufacturers of the nation.

Herbert M. Frazier, formerly of Pittsburgh and Washington, D. C., an expert metallurgist of many years experience, both in industry and government, heads the corporation as its president. Mr. Frazier has many years of practical experience in all phases of the metallurgical field with many years devoted to materials engineering and specifications. *Joseph A. Barile*, formerly with the Royal Plating and Polishing Co. of Pittsfield, Mass., was elected vice-president and general sales manager. Mr. Barile has wide experience in the job plating business with a full knowledge of supplies and equipment. *Wendell P. Barrows* of Washington, D. C., was elected secretary and brings with him an outstanding background of technical and scientific knowledge and extensive practical experience gained from his long association with the National Bureau of Standards and the United States Naval Gun Factory. Mr. Barrows' active participation with the affairs of national technical societies of the metal finishing industry has afforded him a wide acquaintance and a respected position in the industry.

Although the firm is incorporated to handle all supplies and equipment used by the plating and metallurgical industries, it is prepared to act with laboratory facilities and technicians, as consultants on all problems encountered by companies engaged in the business.

Two Michigan Firms Consolidate

Two well-known Michigan firms who represent the nation's leading manufacturers of air moving equipment;

air filter, dust control, heating and ventilating products; and steam heating specialties, have consolidated. *Marshall & Wells Co.*, headed by *Robert L. Wells*, Grand Rapids, and *Air Engineering Co.*, Kalamazoo, headed by *Frank K. Platt*, have consolidated their operations, with *Air Engineering Co.* emerging as the principal firm.

The main office for the new organization will be 521 S. Burdick St., Kalamazoo, Mich., with branches in Grand Rapids, Mich., and South Bend, Ind. Personnel of both firms will remain intact.

Air Engineering will represent American Air Filter Co.'s complete line of air filtration, dust control, heating and ventilating equipment, and Illinois Engineering Co. steam specialties.

MacDermid, Inc., Appoints Johnson

MacDermid Inc., Waterbury, Conn. manufacturer of metal finishing chemicals, recently announced the appointment of *Fred Johnson* as sales engi-



Fred Johnson

neer. He has been assigned to assist *Cecil Thornton* covering the New York State area from Rochester, New York.

Mr. Johnson, former sales engineer for Wagner Brothers, Inc., and chief chemist for Hickock Mfg. Co., is a graduate of the University of Rochester and Rochester Institute of Technology. He is an active member of the



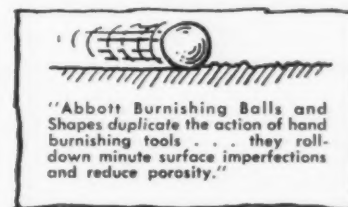
Barrel Finishing Notes: by the abbot

NOTHING BURNISHES LIKE STEEL BALLS AND SHAPES

"Burnishing is a lot like ironing a shirt. It presses and smoothes the surface of the material. For centuries, jewelers, engravers and other craftsmen have done the same thing to metal surfaces with hand burnishers of hardened steel.

"Today, we mass-produce the same fine burnishes with Abbott deep hardened steel Burnishing Materials. Made in six scientifically designed shapes, they're unsurpassed for giving stampings, castings and other parts a *truly burnished* finish. Used in the famous Abbott Vertical Barrel, they save dollars and hours in metal finishing operations."

WANT YOUR COPY OF THE NEW ABBOTT
BURNISHING BROCHURE? WRITE TODAY!



"Abbott Burnishing Balls and Shapes duplicate the action of hand burnishing tools . . . they roll-down minute surface imperfections and reduce porosity."

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HIGHER LUSTRE IN BARREL TUMBLING FOR ZINC DIE CASTING

You can save as much as 90% in time in barrel processing zinc and aluminum die castings with specially developed **PERMAG** compounds.

FOR BARREL COLORING— **PERMAG #338**

It will save you time and money. It takes only 45 minutes with but $\frac{1}{4}$ of an ounce per gallon of **PERMAG #338**, to do a superior job on a barrel-load of zinc and aluminum die castings. For far better jobs, investigate the many advantages of **PERMAG #338**.

FOR BARREL DEBURRING— **PERMAG #370**

Satisfactory results in your deburring operations are possible with **PERMAG #370**, specifically developed for barrel deburring of all metallic parts. **PERMAG #370** is efficient, economical and also useful as a rinsing agent.

Write today for samples and complete data on these and other **PERMAG** compounds, or for the assistance of **PERMAG** technicians on any tumbling or cleaning problems you may have.



MAGNUSON

PRODUCTS CORPORATION

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In Canada: Canadian PERMAG Products, Ltd., Montreal

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A.E.S. and served as secretary of the Rochester Branch for the past two years.

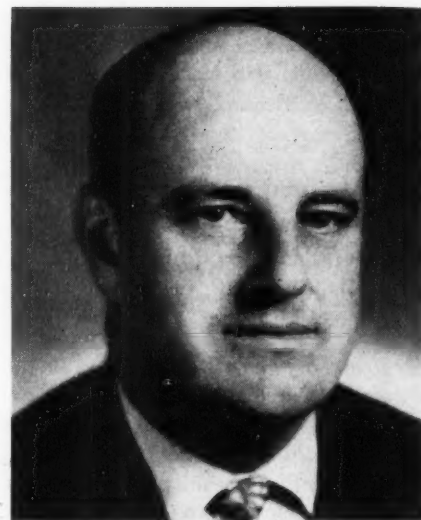
Ey Appointed Manager of H-VW-M Cleaner Sales

Hanson-Van Winkle-Munning Co., leading manufacturers of electroplating and anodizing processes, equipment and supplies, has announced the appointment of *Herman A. Ey, Jr.*, as manager of cleaner sales. His headquarters will be located in Grand Rapids, Mich., at the company's midwest cleaner plant.

Formerly president of Mido Products, a specialized chemical cleaning products firm in Torrance, Calif., Mr. Ey has had extensive sales experience in the chemical cleaner field. He supervised promotion and sales, and in addition, maintained active participation in developing new products and equipment.

Mr. Ey has been on the sales staffs of Sundmark Supply Co., of Los Angeles, the Kelite Products Corp. of Los Angeles and Scobell Chemical Co. of Rochester, N. Y. His sales background includes electroplating supplies and equipment, as well as specialized cleaning products and equipment for barrel finishing.

He is a member of the American Chemical Society, the American Electroplaters' Society, the Chemical Market Research Group, and the organiza-



Herman A. Ey, Jr.

tion of Southern California Chemical Salesmen. He attended DeVaux Military School and the University of California at Los Angeles, doing studies in engineering.

J. R. Schaffner Rejoins Firm

Having completed his two year tour of duty with the United States Army in March of this year, *James R. Schaffner* has been participating in an intensive research program to more thoroughly qualify himself as a sales asset for the *Schaffner Mfg. Co., Inc.*

Upon the completion of his research program, Mr. Schaffner will be working in sales, under the direction of *Paul E. Schaffner*, in conjunction with

BUFFS FOR INSIDE POLISHING



GOBLET BUFFS, TAPER BUFFS, CYLINDER BUFFS, SMALL POLISHING WHEELS, RAZOR EDGE BUFFS, and many others for deburring, polishing and grinding any internal contour.

Write for additional information or contact your local dealer. These buffs are stocked by many dealers throughout the country.

We manufacture a COMPLETE LINE OF BUFFS including full disc loose and sewed buffs and polishing wheels. Our metal center BIAS TYPE BUFF may help cut your polishing costs.

Your request on your letterhead will bring our complete catalog by return mail.

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Canadian Distributor — LEA PRODUCTS COMPANY, Montreal

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James R. Schaffner

the present expansion program of the company.

Pennsalt Chemicals Corporation Forms Canadian Subsidiary

Pennsalt Chemicals Corp. has announced the formation of a wholly-owned subsidiary in Canada. The new component will be known as *Pennsalt Chemicals of Canada, Ltd.*

William B. Billingsley, who has directed the firm's specialty sales in Canada since 1954, has been named vice president of the new subsidiary and resident manager of its operations. Before joining the company, Mr. Billingsley was associated with Canadian Industries, Ltd.

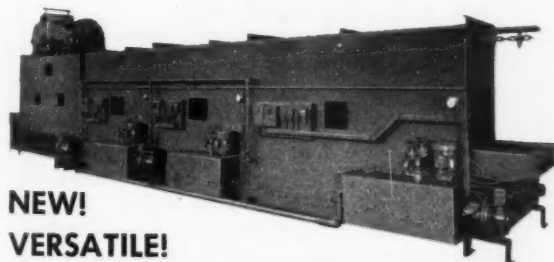
Egan Joins Van Straaten Chemical Co.

John J. Egan, Jr., has joined *Van Straaten Chem. Co.* of Chicago as general sales manager. He has a background of industrial sales management experience with several large companies, as well as technical experience as a production and methods engineer. He began his business career as a production and methods engineer for Yale and Towne Mfg. Co., joining them in 1935 after graduating from Dartmouth. He then was successively senior industrial engineer, Titeflex, Inc., Newark, N. J., 1941-1945; industrial sales manager, Dodge & Seymour, New York, 1946-50; midwestern regional manager, Lamson Corp., 1951-52; sales manager, Virginia Metal Products, Orange, Va., 1953-54; northwest sales manager, Ramset Division of Olin-Mathieson Chemical Corp., 1955-56.

The new 43-year-old general sales manager is a member of the American Society of Lubrication Engineers and the New York Athletic Club. He will live in Barrington Hills, a suburb of Chicago.

Frederic B. Stevens, Inc. Appoints Baker

Noble E. Baker has been appointed as the Central Ohio sales representative for *Frederic B. Stevens, Inc., Metal Finishing Division*. For the past two



**NEW!
VERSATILE!**

A-F Cleaning, Phosphate Coating and Drying Machine

For most effective power spray coverage and draining — to meet the varying cleaning requirements of different types of stampings — both an A-F Overhead Conveyor and an A-F Flat Wire Mesh Belt Conveyor pass through this machine.

This new A-F "Siamese Twin" Cleaning, Phosphate Coating and Drying Machine is only one example of A-F creative engineering in the field of cleaning and finishing metal parts and products. Whatever your problem in this field, A-F can help you solve it!

Write today for FREE 28-page illustrated brochure.

A-F ENGINEERED Cleaning and Finishing Machines
Plant-Wide Conveying Systems
Pre-Engineered Conveyors—Rollers, Wheel, Belt, Trolley

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**DOES THE WORK
OF 2 MACHINES
COSTS 40% LESS!**



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A FULL LINE OF

**Luster-on
POWDERS**

**FOR CHROMATE
TREATING**

ZINC

- #50: Bright, clear, lustrous, nickel-like, corrosion-resistant; requires leach.
- #51: Similar to #50, but bluish chrome-like color.
- #52: Low-cost, no leach, bright, passive.

CADMIUM

- #50: See under Zinc, above.
- #53: Improved solubility, control, safety in handling; requires leach.

COPPER & BRASS

- Cobra: Bright, yellowish, decorative and/or protective film, non-fuming, single dip.

ALUMINUM

- 222M Sealer: Clear or colored film for corrosion protection and paint bond.

MAGNESIUM

- MPD 60: Yellowish film for corrosion protection and paint base.

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Montreal



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years, Baker has been employed as an equipment service engineer operating from the company's Springfield, Ohio plant.

Prior to joining the firm, he was a technical foreman at Steel Products Engineering Co., Springfield, Ohio, for five years.

Baker attended Ohio State Univer-



Noble E. Baker

sity where he majored in Chemical Engineering. During World War II he served three years as a Medical Administrator with the U. S. Navy.

Diamond Alkali Inter-American Corp. Appoints Distributor

Diamond Alkali Inter-American Corp. of New York has appointed *Nicromatic Ltd.* of Toronto as Canadian distributor of chromic acid in the electroplating industry, according to an announcement.

MacDermid, Inc. Opens West Coast Division

MacDermid Inc., Waterbury, Conn. and Detroit, Mich. manufacturer of metal cleaning, plating and finishing chemicals, recently announced the opening of a West coast division, *MacDermid Pacific Inc.*

Complete manufacturing warehousing, sales and service facilities are now in operation. The new division, headed by *Claude E. Weekly*, former product service engineer, will have its head-

quarters temporarily located at 18802 Fonthill, Torrance, Calif.

Mr. Weekly has been active in all phases of cleaning, plating and finishing metals for twenty years. At various times in his career he has been a foreman, finishing room supervisor, metal finishing consultant and service manager. He is a charter member and past-



Claude E. Weekly

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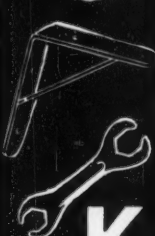
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president of the Indianapolis Branch, A. E. S.

Directors of Alsop Engineering Corp. Elect Officers

At their regular meeting on June 26th, the directors of the *Alsop Engineering Corp.* voted the following changes in the officers to take effect



Samuel Alsop

immediately: *Charles E. Crowley* will be chairman of the board of directors, *Samuel Alsop* will take over the office of the president, *Elias Z. Ross* continues as treasurer, *Clark C. Morgan* continues as secretary, and *Joseph Zoufaly* continues as director.

Mr. Alsop has been executive vice president of the company since 1949 and has functioned primarily in engineering and sales in this capacity.

Gulton to Produce Laminage Under General Motors License

Gulton Industries, Inc., has been awarded a license for the production of the Laminage, under patent rights held by the *General Motors Corp.*

The licensing agreement between the two companies is non-exclusive.

Klem Appoints Stalo

Klem Chemicals Inc., Dearborn, Mich. manufacturers of chemicals for metal surface prefinish cleaning, has announced the appointment of *Edwin E. Stalo* as Indiana representative.

Mr. Stalo, who will contact indus-

trial plants in Indiana, has had many years experience in the metal cleaning field.

Yoder Heads Tranter Research and Development

To meet the ever increasing demand for new products, *Tranter Mfg. Inc.*, Lansing, Mich., has instituted a pro-



C. P. Yoder

**FOR QUALITY and UNIFORMITY
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HARRISON  PRODUCTS

**STAINLESS STEEL
BUFFING & POLISHING COMPOUNDS**

**Faster Cutting — Increased Production
Economy**

**NEW TRIPOLIS
FAST CUT — ALL PURPOSE —
PRESAPONIFIED, CUT & COLOR
LIME CAKE**

**Consult Us On Any Of Your Problems
We'll Gladly Advise And Send Samples**

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**12 gal. SEMI-HARD RUBBER
CONTAINER For Acids
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**Will outlast stoneware jars or
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—Light weight and easy to
move. \$15.00**

**STURDY STEEL BASKETS —
(shown in drum) For cleaning
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Rugged PLASTIC COATED Pails - Dippers



2-QT. SIZE \$3.30 12-QT. SIZE \$6.95

Dependable PPI Products . . .

**• PLATING RACKS • RUBBER DRUM LINERS • ACID
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LINED TANKS • PLASTIC LINED TANKS • POLYETHY-
LENE PAILS & CONTAINERS • FUME SEPARATORS •
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**Inside Dimensions
14" Wide 18" Deep**

**Will
withstand
practically
all acids and
alkalies.
"Costs less
than rubber
— Longer
service
than enamel."**

**ORDER
TODAY**

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duct research and development department. The new department is under the direction of C. P. (Bill) Yoder.

Yoder has been with the firm since 1949. For the past four years he has been assistant general sales manager. Replacing Yoder as assistant general sales manager is Bob Saxton who has been with the company since 1951.

Calaceto Joins Division of ARco

Recently announced by *Automotive Rubber Company, Inc.*, Detroit, is the appointment of Ralph R. Calaceto as manager and sales engineer of their *Process Equipment Division* in New York City.

A native of Brooklyn, N. Y., and at present residing with his family in Ridgewood, N. J., Mr. Calaceto comes to the company with a vast knowledge of the chemical and allied industries, receiving his bachelors degree from Pratt Institute of Brooklyn and his masters degree in chemical engineering from Brooklyn Polytechnical Institute.

Mr. Calaceto's sales duties will be in



Ralph R. Calaceto

connection with the development of equipment and processes for waste and recovery systems in the chemical and allied industries.

Before joining the ARco family, Ralph served 6½ years as project engineer with the Chemical Construction Corp. of New York City. For 2 years prior to this position he was general

plant manager for the Metal Coloring Corp. of Paterson, N. J.

Armour & Co. Appoints Gilbert and Wilhelm

Tracy Gilbert has been appointed sales supervisor, *Coated Abrasives Div., Armour and Co.*, Alliance, Ohio. His territory will be Toledo and the surrounding area of Ohio.

He is a native of Toledo and attended public schools and the University of Toledo. He has been in various sales capacities prior to his appointment.

K. Emerson Wilhelm has been appointed to the new position of regional sales manager, and will make his headquarters in Cleveland.

Mr. Wilhelm has been a sales supervisor since August 1950 in Cleveland and Massillon, Ohio. He attended public schools in Massillon and served in various sales capacities prior to his appointment.

Becco Breaks Ground for New Distributing Center

Becco Chemical Division of Food



BUY **For the Finest in PLATING RECTIFIERS**

A BETTER SOURCE OF DC POWER — MORE FOR YOUR MONEY

- ★ Operate from —40° to 225° F.
- ★ 50 to 50,000 Amperes DC
- ★ Built-in Voltage Regulator and Meters
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Two styles available—1. Selenium for cool zones, or 2. Magnesium copper sulphide for the hot, dirty jobs. Units still running after 4 years of constant duty.




Replacement Rectifier Stacks for Lektron or Udylyte-Mallory

Magnesium copper sulphide rectifiers make your plating power supply more rugged and dependable. Magnesium radiator fins for fast heat dissipation and lighter weight. Matching pairs.

Model 4045—750 amps at 12 volts DC—1500 amps. at 6 volts D.C. Operates on 208, 220 or 440 A.C. Weight 525 lbs. F.O.B. Indianapolis, Indiana.

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- ROLLED ELECTROLYTIC COPPER ANODES
- ROLLED ELECTROLYTIC PHOSPHORIZED COPPER ANODES
- CAST ELECTROLYTIC COPPER ANODES — All Shapes
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Machinery and Chemical Corp., Buffalo, N. Y., has broken ground for a new distributing center in Framingham, Mass., to serve the New England area.

The new center will be located on Fountain St. just west of Route 128 and will occupy an area of approximately 6,000 sq. ft. on 22,000 sq. ft. of land, thus permitting ample room for future expansion. It will replace the company's former distribution center in downtown Boston, established in 1933 and now outgrown.

Philip D. Caine, New England manager will be in charge of the new distributing center.

Cochrane Corp. Elects Denton V. P.

Cochrane Corp., Philadelphia manufacturers of water conditioning and steam power equipment, announces the election of *Joseph R. Denton*, as vice president, New York, district sales.

Mr. Denton is a chemical engineering graduate of Georgia Institute of



Joseph R. Denton

Technology. He was formerly associated with Calco Chemical Division of American Cyanamid Co., and thereafter spent several years in the New York office of Worthington Corp. as a sales engineer. He joined Cochrane in 1954, as manager of its New York district sales office.

Avery Smith Joins Comco

Comco, Inc., division of *Enthone, Inc.*, New Haven, Conn., has announced the appointment of *Avery Smith* as assistant to the general manager, *J. J. Martin, Jr.* Mr. Smith will assist in the preparation of proposals for plating room equipment and will fulfill a liaison function between customers' requirements and the manufacturer's facilities.

Mr. Smith was formerly associated with the engineering department of American Machine and Foundry Corp., Deep River, Conn. His military service consisted of seven years with the U. S. Air Force in Alaska, Hawaii and Headquarters U. S. A. F. Pentagon, Washington, D. C.

Diamond Alkali Promotes Two

Promotion of two veteran technical employees of *Diamond Alkali Co.* to new positions of broader responsibility in this chemical producer's research organization at Painesville, Ohio, was announced recently.

CLOTH BUFFS

ZIPPO

- High Count, Heavy Duty, Bias-cut Cloth.
- Extra folds provide wider buff face and greater compound holding capacity.
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- Perfectly balanced sections require no raking.

FORMAX BUFFS—These famous fast cutting and long wearing buffs continue to set the standard of performance for bias-type cloth buffs. You can depend on uniform quality from shipment to shipment.

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over 25 models designed to fit your needs from 50-3000 gal. per hr.

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FILTER PUMP UNITS

- no leakage, no metal contamination
- SELF-PRIMING
- with all-plastic self-priming pump and transparent plastic filter chamber. Anti-corrosive plastic construction uses BunaN, H. T. Lucite, Neoprene, Teflon, Rigid PVC, Hypalon, vinyl, etc. Removes particles down to one micron.
- AUTOMATIC BACKWASH REVERSAL SWITCH
- COMPACT
- PORTABLE
- ECONOMICAL

Sethco Mfg. Co., 2286 Babylon Turnpike, Merrick, L. I., N. Y.

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Dr. Clifford A. Neros becomes group leader in the product development section of the Central Research Department. With headquarters at the firm's research center, he will continue to direct laboratory work relating to product evaluation and applications research on new chemicals and plastics.



Dr. Clifford A. Neros

James L. Foster is now group leader in silicate research for the Silicate, Detergent, Calcium Division. He will be responsible for development of new silicate products and will be concerned with maintenance and improvement of quality control standards at the company's various silicate plants.



James L. Foster

Wiretex Appoints New Representative

Appointment of the L. H. Lundstedt Co., 4554 Broadway, Chicago, Ill., as Illinois and Wisconsin representatives has been announced by Wiretex Mfg. Co., Inc.



L. H. Lundstedt

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BRASS SOLUTIONS

Trouble Free — Low Cost
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1957*

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Cowles Appoints New Technical Service Men

Arthur H. Coapman, Wilbert M. Radtke and Homer B. Welch have been selected as new technical service men by Cowles Chemical Co., Cleveland, Ohio.

Mr. Coapman will handle the sales and services of company products in Detroit and nearby cities. He has had considerable experience in the plating business, having owned and operated a plant in Minnesota. Mr. Radtke will be in charge of the sales & services in

Indiana, making his headquarters in Indianapolis. He has had considerable experience in the metal finishing trade for the past 8 years. Mr. Welch will handle the sales and services of the company's line in outstate Michigan. Mr. Welch is well qualified, having 13 years experience in the plating business



Arthur H. Coapman



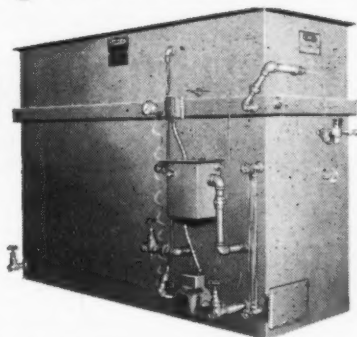
Wilbert M. Radtke



Homer E. Welch

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New, modern Circo vapor degreasers—whether large or small—are engineered to save on solvent consumption. Construction features like balanced condensing coils, leak-proof pumps and dual vapor-level control are today saving companies 30% and often more in solvent use. Circo degreasers perform faster, save precious man-hours through engineering designs developed through 30 years experience in vapor degreasing.

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Metal Parts Washers
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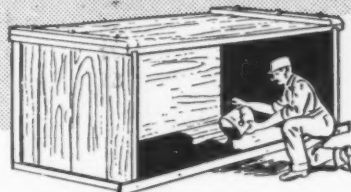
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Easy to Apply RUBBERITE TANK LINING



**Just heat
to 300° F.
and pour**

Provides a lasting lining that withstands acids and caustics at room temperatures. A standby of Platers for over 25 years. Effectively protects wood or steel tanks. Easily applied in your own shop—just turn tank on side and fasten board on edge as illustrated. Then heat Belke Rubberite to 300° F. and pour over surface. Surfaces to be coated require no special preparation but should be reasonably clean.

When Rubberite cools, it has characteristics similar to soft rubber. Will not crack, scale, or run in the hottest weather. Write for complete information.

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in Jackson, Mich., where he will make his headquarters.

Platzman Forms New Firm

Paul Martin Platzman, New York industrialist and one of the leading specialists in ultrasonics, has announced the formation of a new, major company in the ultrasonic industry. The new organization, with headquarters in Mineola, L. I., will be in operation by mid-September. Several of the ultrasonic industry's outstanding generator and transducer design and applications engineers have been recruited for key positions. Participating with Mr. Platzman as principles will be two companies prominent in the electronic and metal cleaning fields. Initial capitalization will be not less than a quarter of a million dollars. Final negotiations are nearing completion.

Mr. Platzman recently resigned as director and vice president of Acoustica Associates, Inc., a Long Island company he helped found, to devote his entire interests to the new enterprise.

Wagner Bros. Opens New Office

Eastern users of automatic plating machinery, allied equipment and chemicals will now be able to make direct purchases and obtain technical assistance through a new office branch established in New York by *Wagner Brothers Inc.*, Detroit, Mich.

The new office, at 109 Baker St., East Syracuse, N. Y., will cover all of New York state and northern Pennsylvania. Its operation will be directed by *Tom Kohler*, newly appointed district manager, who was a sales engineer in the firm's main office in Detroit, prior to his appointment.

Diamond Alkali Elects Executives

Election of four key executives of *Diamond Alkali Co.*, Cleveland, Ohio, to new management assignments has been announced at the firm's national headquarters.

A. H. Ingley, vice president — manufacturing for the past nine years and a director since April, now becomes

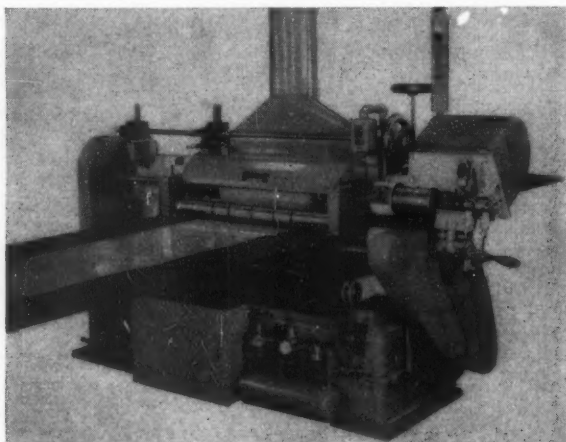
senior vice president, a newly-created position. *James A. Hughes*, treasurer of the company since mid-1955, is now advanced to vice president — administration, also a new post in the organization. *Donald S. Carmichael*, secretary for ten years, is named to the additional post of general counsel. *R. H. Armor*, assistant treasurer since 1953, succeeds Hughes as treasurer.

As senior vice president, Mr. Ingley, a veteran of 37 years' service with the firm will assist and back up company president *John A. Sargent* in the interpretation, coordination and execution of long-term plans and policies affecting the company's activities through its seven operating divisions and other organizational units.

T. C. Bierdeman Heads Klem Office in Milwaukee

Klem Chemicals, Inc. of Dearborn, Mich., has announced the appointment of *T. C. Bierdeman* as the district manager of the Wisconsin and Illinois territory.

Mr. Bierdeman has had several years



Clair Model 209 Pinch-Roll Thru-Feed Surface Finishing Machine

for SHEET or COIL STOCK

Incredibly versatile — — the CLAIR model 209 will handle ANY type of surface finishing operation — — PLUS broadened applications for delusterization of transparent plastic film, printed circuitry applications, etc., etc. It will accommodate any type or kind of long sheet and continuous coil stock in metals, plastics — — or whatever you have in mind for surface finishing.

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▶METAL FINISHING
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KANSAS CITY 8, MO.
813 W. 17th St.
BALTIMORE 1-2128

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of experience in the industrial metal cleaning field in Milwaukee while covering the St. Louis territory for the firm.

Acoustica Announces Move and Appointment

Acoustica Associates, Inc., designers and manufacturers of ultrasonic cleaning units, announce their move from Glenwood Landing to new and larger quarters at 26 Windsor Ave., Mineola, L. I. on September 1st, 1957. Their new telephone number will be Pioneer 7-7900.

Ralph Reynolds, formerly technical sales manager, has been appointed general sales manager. A graduate of University of Wisconsin, majoring in chemistry, he has been with the firm since its inception, and is one of five directors.

Prior to this, Mr. Reynolds was on the Socony-Mobil research & development laboratories and technical service staffs. From there he went to Kelite Corp. as a member of the technical sales department.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

New York Branch

The New York Branch of the American Electroplaters' Society will hold its Annual Educational Session and Banquet February 1, 1958 in the Penn Top of the Hotel Statler at 8:00 p.m. The Technical Session will be held in the afternoon at 2:30 p.m.

Educational chairman Arthur Carlson has arranged an outstanding program which is as follows:

"Research in Electrodeposition in Progress at the National Bureau of Standards" by Dr. Abner Brenner, Director, Electrochemicals Div., National Bureau of Standards, Washington, D. C.

"Recent Developments in Bright Leveling Nickel Deposits" by Mr. Myron Diggin, Technical Director, Hanson-Van Winkle-Munning Co., Matawan, N. J.

"Seeing Plating Solutions in Action" by Dr. Walter R. Meyer, President, Enthone, Inc., New Haven, Conn.

John Melhado, chairman of the Ladies Program, is busy arranging a party for the women which will really keep them entertained while the men are attending the educational session.

Dick Hartman, chairman of the Entertainment Committee, is again lining up an outstanding floor show, which will follow the banquet. As usual, a fine orchestra will supply the music for dancing throughout the evening.

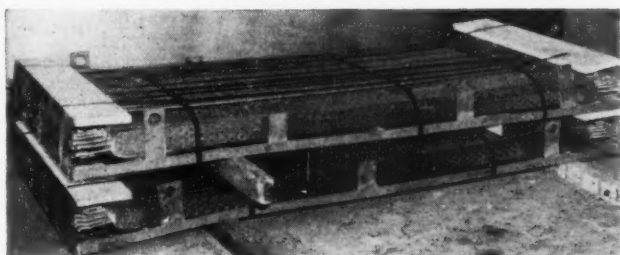
Derick Hartshorn, Jr.
Publicity Chairman

Detroit Branch

The Detroit Branch had numerous summer activities, such as the annual Stag Day outing, held at the Glen Oaks Country Club on July 27th. In

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STORTS Perforated Anodes are specially designed to provide better current distribution — dozens of edges do it. Available in any lengths, in lead or steel, they are ruggedly built for long wear, handle easily and clean easily. Hooks can be supplied in varied designs to meet different conditions, and in a range of sizes.

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spite of the 90 degree temperatures, approximately 1200 members and their guests enjoyed themselves with an excellent program headed by *John F. Siefen*, chairman. His Committee consisted of the following members: *John Hitchcock*, *John Daily*, *Bob Spaulding*, *Bill Katke*, *Wright Wilson*, *Carl Anderson*, with an advisory committee of: *Manuel Ben*, *Herb Head*, *Cleve Nixon* and *Walter Pinner*.

Executive Group dinner meetings were conducted by President *Glenn Freidt, Jr.* on July 7th and August 1st, at the Statler Hotel.

An electroplating course started on September 17th, the first meeting of a 12 week series. The course will provide the necessary scientific background to better understand the reactions and information available on plating processes. This course is being offered by the Detroit Public Schools at the request of the Detroit Branch. *Fred Brune* is AES Chairman of this program.

A new Detroit Branch Directory was recently released, the first since

1948. This pocket-sized booklet includes members and their company affiliations, a yearly program schedule listing the particular speakers and their subjects, standing committee and various tables on valuable metal finishing information. The booklet was subsidized by advertisements from vendors represented in this area, without expense to the Branch. This booklet was established at the suggestion of the Long Range Planning Committee, chaired by *Cleve Nixon*. The chairman of the booklet committee was *Manuel Ben*, with a committee of the following: *Doug Thomas*, *Don Bigge*, *Cleve Nixon*, *John Drinkwater*, *Ed Kubis*, *Fred Olmstead*, *Bert Lewis*, *Wright Wilson*, *Lee Morse*, *Jim Mueller*, *Howard McAleer*, *Herb Head*, *Glenn Freidt, Jr.* Technical assistance was given by *Al Bohn*, General Motors Research.

The following chairmen were appointed: *Bert Lewis* as branch historian and *Bob Amis* on publicity.

John Drinkwater

Public Relations Director

N. A. C. E.

Six speakers at a short course scheduled November 13-16 at Key Biscayne Hotel, Key Biscayne, Florida by the Miami Section, National Association of Corrosion Engineers have been named. The section will hold a technical conference and short course.

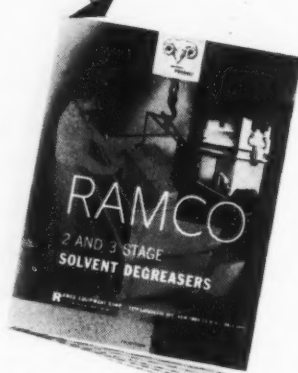
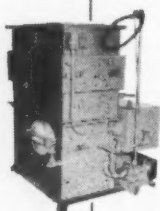
Those named are *J. B. Prime, Jr.* and *E. Tilton*, Florida Power and Light Company, Miami; *Henry T. Payne*, Chemical Engineering Dept., and *Sigmund Miller*, Marine Laboratory, University of Florida; *Raymond F. Hadley*, Sun Oil Pipe Line Co., Philadelphia and *Wayne Broyles*, Brance-Kracy Co., Inc., Houston, Tex.

N. A. M. F.

W. Wilson Loveless, vice president, Varland Metal Service, Inc., will be responsible for the overall planning of the 1958 convention of the management organization within the metal finishing field which will be held at the Sheraton-Gibson Hotel, Cincinnati May 18 and 19.

Q metal parts A cleaning problems ?

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Loveless is the current president of the Cincinnati branch, American Electroplaters' Society.

The 41 year-old native of Balsalm Lake, Wisconsin attended the University of Cincinnati and served 2½ years in the Army in World War II. He is married and has three children.

Al Marinaro New York Executive Secretary

A New Jersey man was named recently to the executive secretary's post of one of the largest affiliates of the *National Association of Metal Finishers*. Thirty-nine-year old *Alfred T. Marinaro* assumed his duties as chief administrator of the *Masters' Electro-Plating Ass'n.* of New York last month, filling the vacancy created by the death of *Silvio C. Taormina* in June.

The new executive secretary formally entered the metal finishing field in 1947 when he joined Platers Research Corp., New York, as vice president. Previously, he was production supervisor at Shawinigan Resins Corp.,



Alfred T. Marinaro

division of Monsanto Chemical Corp., Springfield, Mass.

Marinaro is now the managing director of Platers' Technical Service, Inc. and Platers' Research Corp., of New York and Chicago. A graduate of the Newark College of Engineering, he received his BS in Ch. E. and MS in

Ch. E. from Columbia University in the early 1940's.

He holds several patents in the plastics field and more recently was issued patents in the electroplating of gold and gold alloys.

Active in church and community work, Marinaro is president for the second consecutive year of the 4th Degree, Knights of Columbus. He is a member of the American Institute of Chemical Engineers and the American Chemical Society.

Marinaro is married and resides at Verona, New Jersey, with his wife, Gilda, and three children.

AMERICAN ZINC INSTITUTE

The Galvanizers Committee of the steel industry, which is sponsored by the *American Zinc Institute*, will hold its thirty-seventh meeting on October 31-November 1, 1957 at the Pick-Ohio Hotel, Youngstown, Ohio. This committee consists of technical and operating representatives of the major steel producers in the United States and

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Canada who are also engaged in galvanizing sheet or pipe.

E. P. Beachum, Bethlehem Steel Co. is current chairman of the committee. Chairman of the program subcommittee is K. S. Fitzsimmons, Republic Steel Corp. with N. B. Juster, Inland Steel Co. as vice chairman.

News from California

By Fred A. Herr



Don L. Bedwell, who has been in semi-retirement for the past 2½ years, went into permanent retirement on August 1 from his post as plant superintendent for the Hallenschied - McDonald Co. of Los Angeles.

He has been succeeded as plant super-

intendent by George "Bud" McDonald, son of G. D. McDonald, co-founder of the firm with G. A. Hallenschied in the 1920's.

Bedwell has been superintendent of the plant at 1380 West Washington Blvd., for the past 21 years. In the early 1930's, while he operated the De Luxe Plating Co. in Los Angeles, one of his best customers for job plating of plumbing fixtures was the Hall-Mack Co. In 1936 the company decided to buy out the Deluxe Plating Co. and install Don as general superintendent of their own operations. He has held the post since that time, with occasional motions toward semi-retirement, meanwhile training young McDonald for the job.

Bedwell's career in plating and polishing covers a 52 year span, going back to 1905. All but a few years, when he strayed for a while as far as San Francisco, were spent in Los Angeles. He started in 1905 with the Thorpe Plating Co., a small shop operated at

2nd and Figueroa Sts., in Los Angeles by S. A. Rush. Following that he worked in various Los Angeles job shops doing both plating and polishing. Around 1910 he began specializing in lighting fixture finishing, at which he became an expert.

Don was one of the charter members who founded Los Angeles Branch of the A. E. S. in 1930. He served two years as president and in practically all other chapter offices, general chairman of its annual educational sessions, national convention delegate, and in other capacities. Three years ago his long years of service to the plating industry were climaxed by his election as an honorary life member of the A. E. S.

Don has no clear idea of what he plans to do during retirement. He has some fishing and hunting in mind but, with a 9,000 trip to Australia just recently completed, he and Mrs. Bedwell have no plans for further travel in the immediate future.

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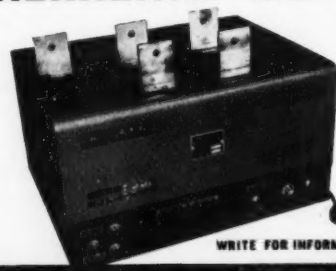
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Quality Metal Finishing Co. of Lynwood, Calif. and Parker Boiler Mfg. Co. of Los Angeles have collaborated in a plan in which high temperature water, heated by steam is used successfully to replace a former method whereby tanks were heated by direct firing over open gas flame.

Quality Metal Finishing Co. specializes in chromate corrosion-resistant conversion coatings and paint base prime coatings. It also does selective cadmium plating and anodizing of cups, helmets, automobile trim parts, and accessories. It operates a complete paint shop for all types of finishing operations.

Its recently completed new plant is equipped with a hot water boiler with an output capacity of 2,800,00 Btu. Water heated to 290°F. is circulated through a coil installed in each tank. Temperatures are maintained so that a variety of operations requiring different temperatures can be processed at the same time.

Officials of Quality Metal Finishing Co. report that the change-over from open-gas flame heating to the present system has reduced fuel costs 60%.

J. Barrie Blackburn has been named technical service representative in Santa Monica, Cal., for Oakite Products, Inc., manufacturers of industrial cleaning, descaling and metal treating compounds. Prior to assuming his new position, Blackburn took an eight-week training course at the firm's headquarters in New York City.

Part I of a two semester night school course in the science and technique of electroplating began September 17 at the Los Angeles Campus of the University of California, with *Mitchell Raskin*, local plating consultant, as the instructor.

The course is being offered as part of the Fall semester curriculum of the school's engineering extension division and is geared for those engaged in some aspect of metal finishing who

wish to broaden their knowledge and experience. The course includes the chemistry of plating, a study of plating and cleaning equipment, pickling and stripping methods, racking of parts, plus detailed lectures and discussion periods on all types of copper, nickel, chromium and other forms of plating, including solution analysis; maintenance and trouble shooting of shop installations, filtering, health and safety practices.

Classes will be held weekly on Tuesday nights from 7 to 9:30 o'clock.

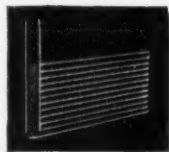
Also being offered is a course in modern metallurgy, for which *John W. Welty*, assistant research director of Solair Aircraft, San Diego, Cal., serves as instructor. This is described as a basic metallurgical course primarily concerned with ferrous alloys. Refinement, production, mechanical properties and factors which influence their selection for various applications are covered. Modern metallurgical methods of control are also included in the discussion periods, as well as methods of interpretation of results. The class will

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meet every Tuesday from 7 to 9:30 p.m., beginning September 17.

Edward O. Morgan recently was appointed general sales manager of the Cee-Bee Chemical Co., of Downey, Cal. Morgan previously served for five years as vice president in charge of sales of Kieruff & Co. in Los Angeles, and prior to that as western sales training manager for Motorola, Inc.

The Engelberg Huller Co. of Syracuse, N. Y., manufactures of abrasive

belt machines, has appointed Lawrence Abbott as a west coast sales engineer covering the territory including California, Arizona, Nevada, Oregon, Washington, and Idaho. His headquarters are at the company's branch office, 2910 Santa Fe Ave., Los Angeles. Abbott was previously active as sales engineer for the Darling Abrasive & Tool Co., San Francisco, and for Mechanics Tool & Supply Co., Oakland.

Chemtrol Corp. of Compton, Calif., has announced the appointment of Donald Jensen as chief engineer, with

supervision over all engineering activities connected with the firm's line of corrosion service plastic valves and piping systems. Jensen, for the past ten years, had served in top engineering capacities with firms specializing in pressure vessel work and piping systems.

Announcement has been made of the appointment of Richard W. Millar, widely known West Coast industrialist, to the board of directors of Turco Products, Inc., Los Angeles, producers of industrial chemical processing compounds.

Millar was chairman of the executive committee of Douglas Aircraft Co. during the 1930's, and resigned in 1938 to assume the presidency of Vultee Aircraft. He formed Avion, Inc., in 1942, and subsequently went to Northrop Aircraft, first as vice president and then as chairman of the board.

The National Conference on Standards will be held on the West Coast for the first time, when the eighth annual session convenes at the St. Francis Hotel in San Francisco on November 14 and 15.

The conference will be held in conjunction with the 39th annual meeting of the American Standards Association, sponsor of the conference.

The principles of the American Standards Association will be under review at the 39th annual meeting of the ASA on November 13. Concurrent sessions on government standards and safety will be held the same day. The sessions on government standards will be sponsored by the Department of Defense, National Bureau of Standards, the U. S. Department of Agriculture, and the Government Services Administration.

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LETTER TO THE EDITOR

Dear Sir:

We were somewhat dismayed by the references to titanium as a material of construction for anodizing racks in your July issue, since we feel the manner of presenting the data may result in misleading your readers.

First, on the question of availability, the author quotes delivery as 3 to 9 months. At Rem-Cru, we have been keenly aware that the anodizer or rack manufacturer cannot live with such deliveries. For this reason, we are currently able to supply the popular wire sizes (.063", .093" and .131" diameters — grade Rem-Cru A-55) in quantities of several thousand pounds promptly. We also have considerable quantity of Rem-Cru A-55 sheet, either at finished gauge, or in process. As a result of this policy, we have delivered 75% of all our orders received for anodizing racks within 30 days.

Second, the author's reference to titanium's behavior in 5 to 15% sulphuric acid solutions should be amplified. Commercially-pure titanium in this strength acid shows corrosion rates 10 to 50 mils per year, generally uniform corrosion rather than "severe pitting." Pre-anodizing drastically reduces this corrosion rate, and when titanium is used in sulphuric anodizing solutions, under anodic conditions, the metal is not attacked. In fact, racks in use for several years have shown no measurable metal loss.

We note that in Table II, the machinability is described as very poor; formability, poor; spring temper, poor and electrical conductivity, poor. Again, the information, as presented, may be misleading. Formability and machinability are comparative terms. While we would not wish to pretend that titanium machines like free cutting brass or bends like 2S aluminum, most of our customers find that once they have gained some shop experience, Rem-Cru A-55 titanium can be handled as easily as the stainless steels. In regard to electrical conductivity, the fact that the metal remains conductive under anodizing conditions is perhaps the key point.

The price of titanium mill product was reduced for the third time in the last year and a half on June 3, 1957.

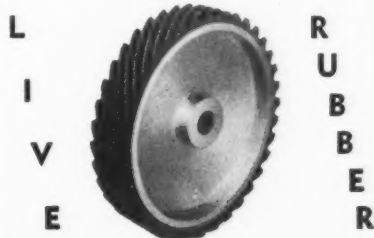
A better estimate for the cost in popular anodizing rack sizes would now be \$10 to \$16 per pound. We will be glad to forward our price list on request. We heartily agree that the choice of titanium "at this cost is purely a matter of relative economics." However, our customers are continually telling us that the higher initial outlay per rack very quickly results in important savings. One customer estimates that every dollar invested in titanium has saved twenty dollars in anodizing costs.

By eliminated stripping cycles and drastically cutting rack replacement, we feel titanium has a real contribution. We invite the evaluation of the anodizing industry, and assure one and all no one will wait 3 to 9 months for delivery.

Cordially,

A. G. Caterson, Supervisor
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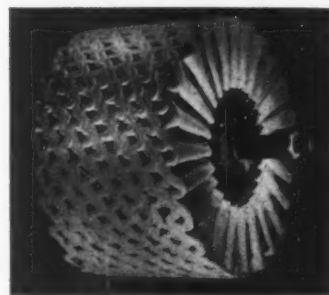
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1—ALMCO DB8 Deburring Barrel, 2

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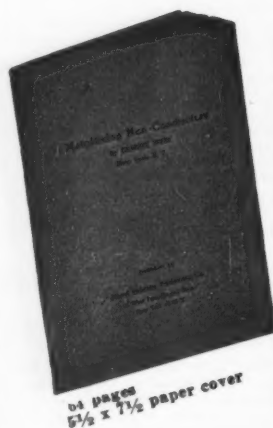
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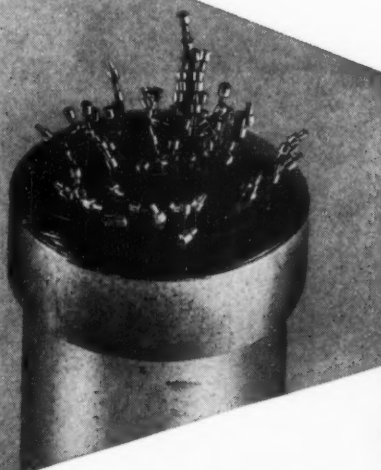
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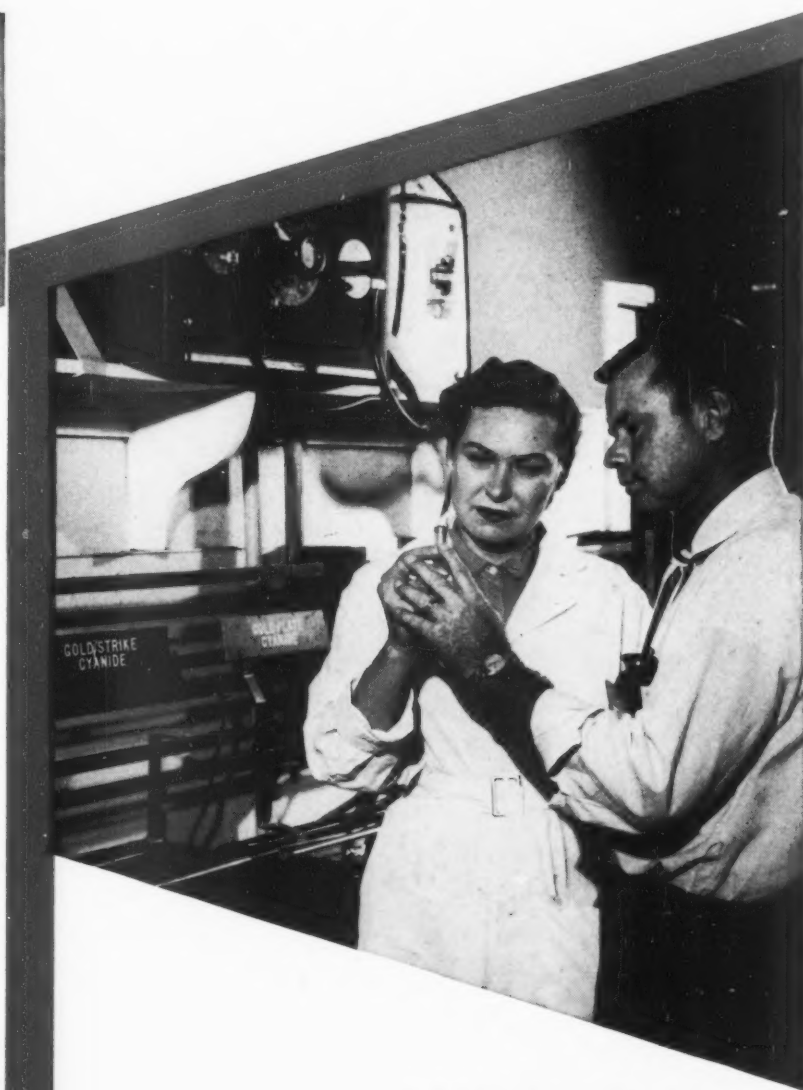
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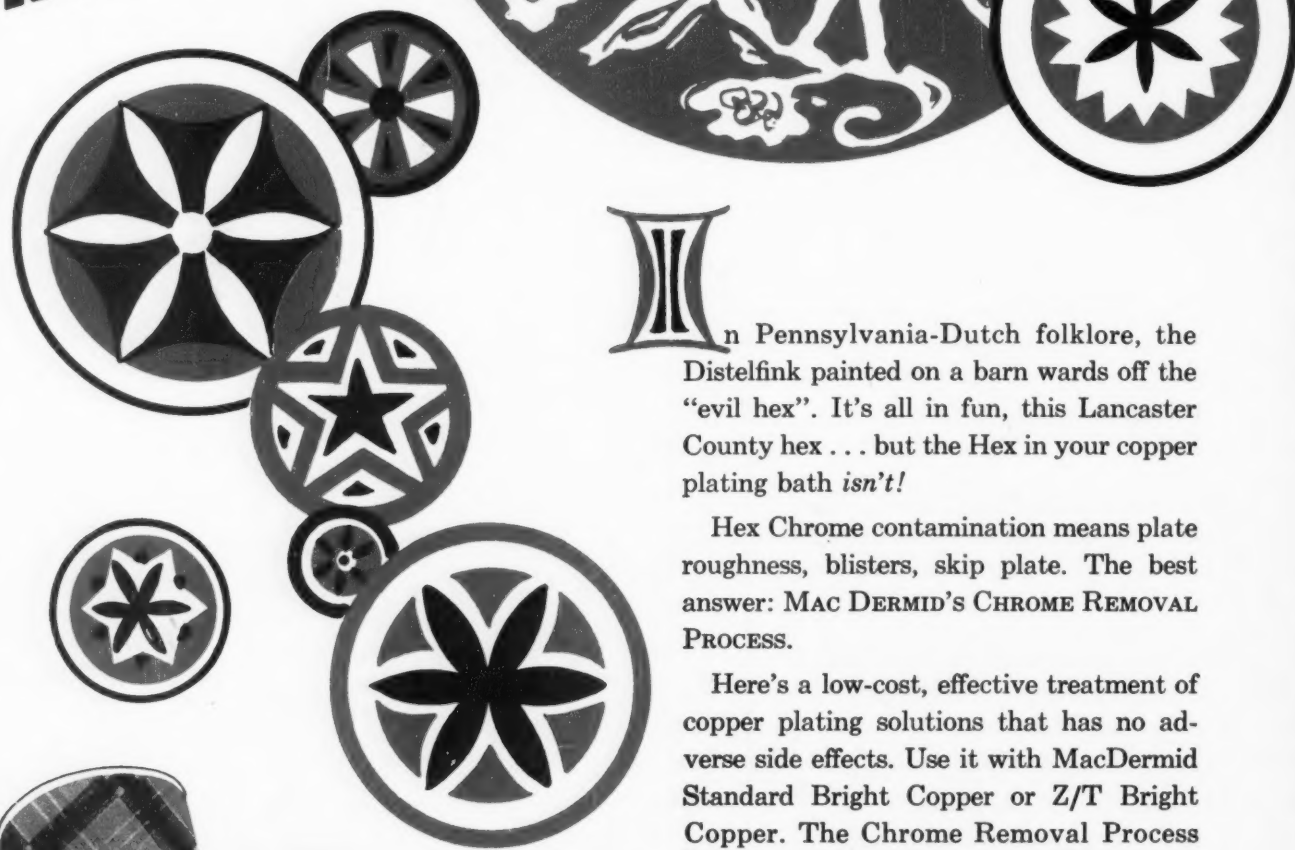
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